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Fuller et al.

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(54) **TRAVELING WATER DELIVERY DEVICE**

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(73) Assignee: **WET**, Sun Valley, CA (US)

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(22) Filed: **Mar. 14, 2014**

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Related U.S. Application Data

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B05B 17/08 (2006.01)
B05B 13/04 (2006.01)

(52) **U.S. Cl.**
CPC ***B05B 17/08*** (2013.01); ***B05B 13/04*** (2013.01)

(58) **Field of Classification Search**
CPC B05B 17/08; B05B 13/04
USPC 239/16–23
See application file for complete search history.

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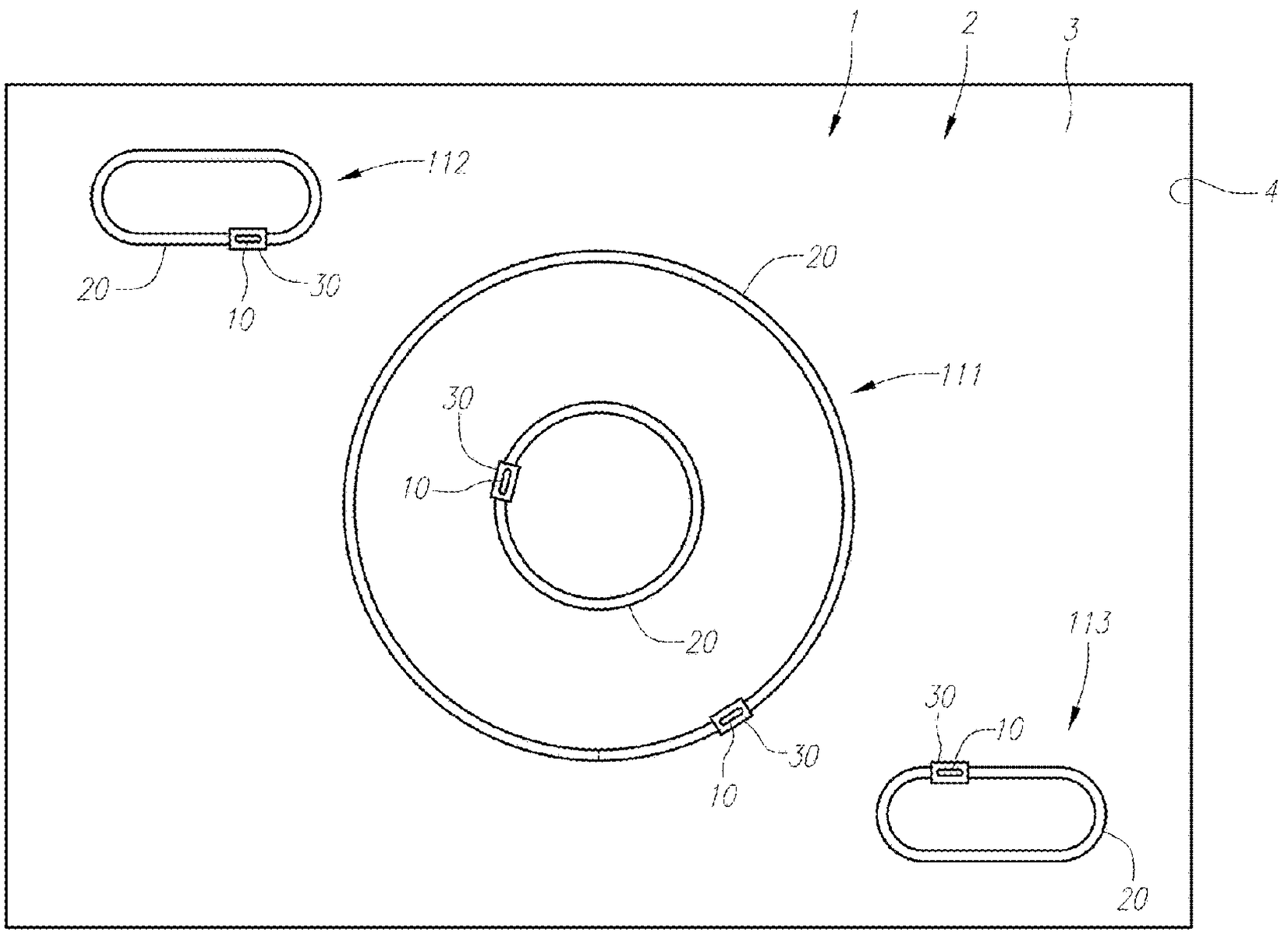
(57) **ABSTRACT**

A device to moving a water shooter is described. The device may contain features that allow the device to travel submerged in a reservoir with a water shooter attached. The device may travel along a fixed track, rotational boom, or be free swimming in order to move the water shooter within the reservoir so that unique water effects may be achieved.

21 Claims, 24 Drawing Sheets



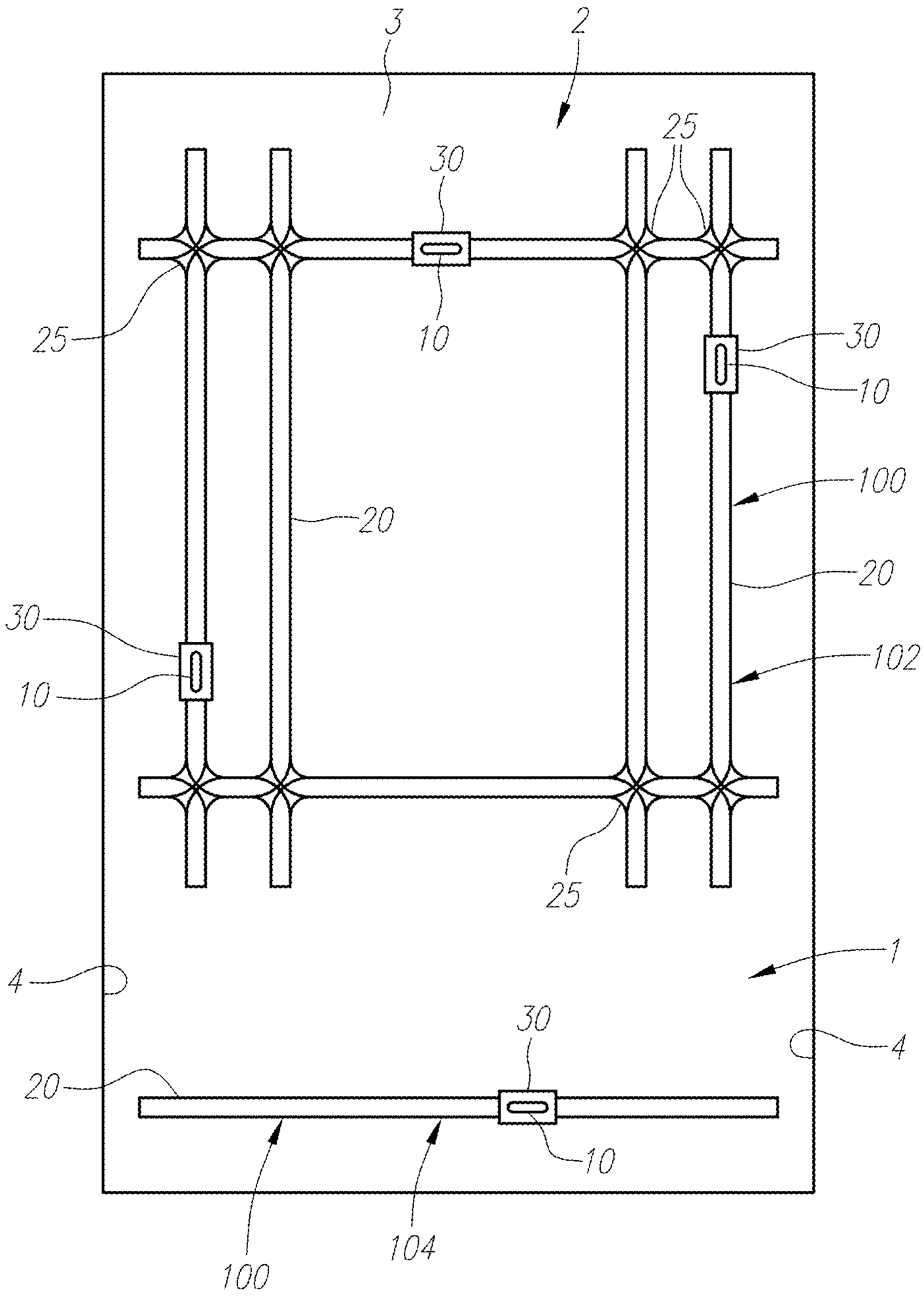

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FIG. 1A

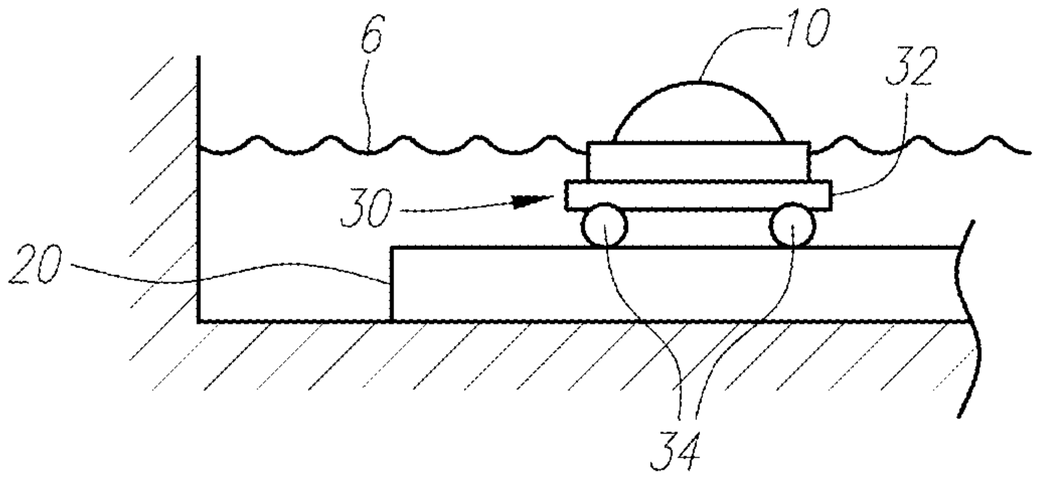
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FIG. 1B

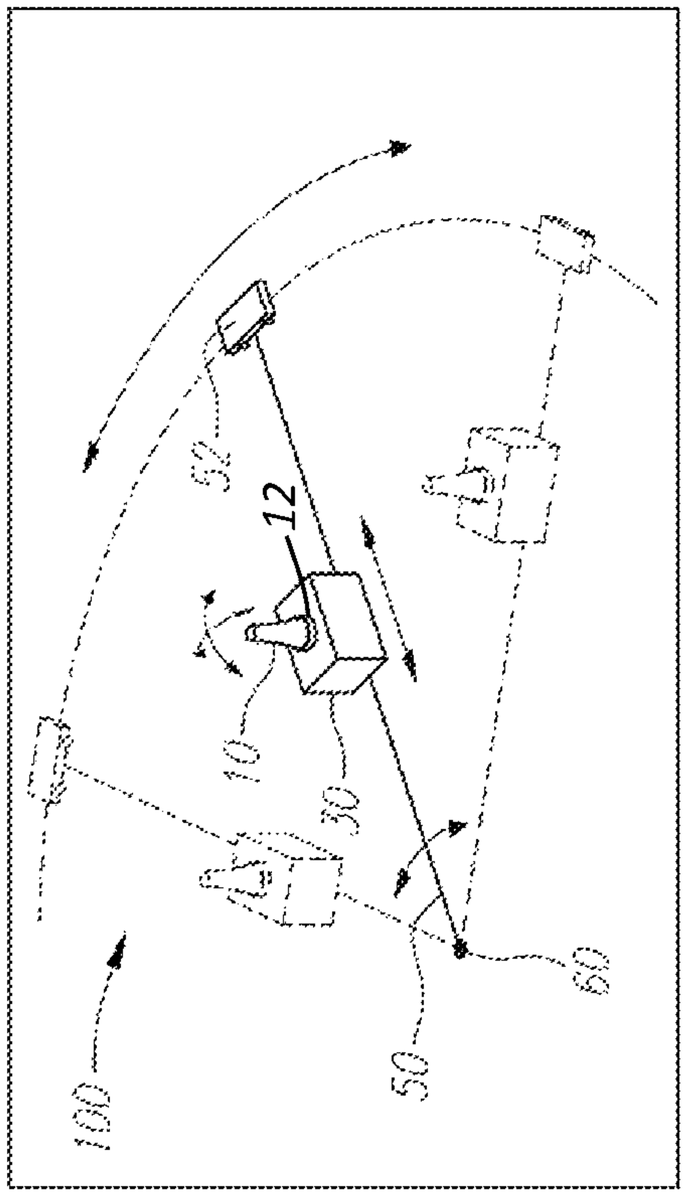


FIG. 2C

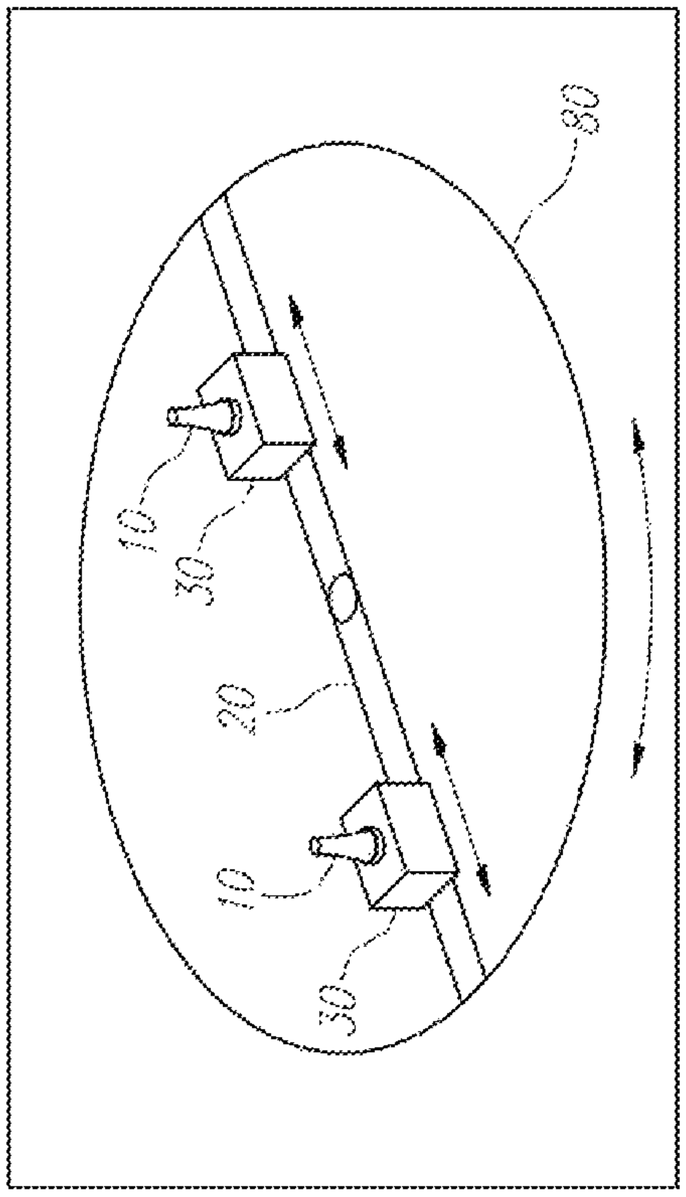


FIG. 4C

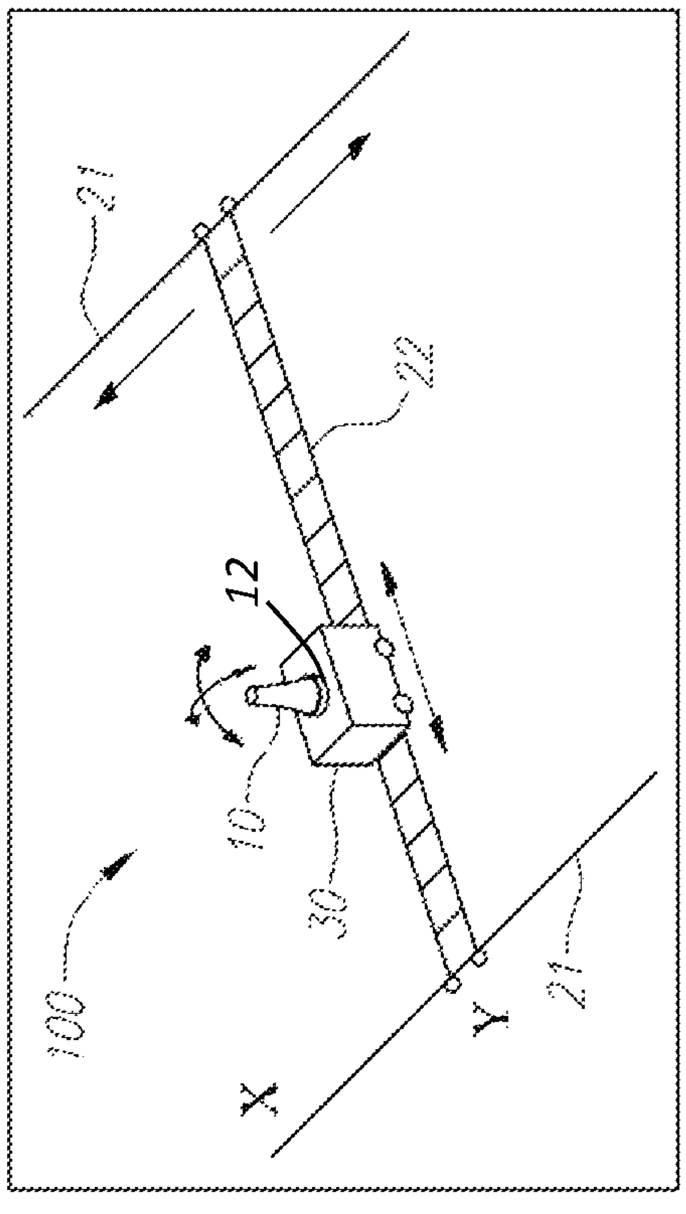


FIG. 1C

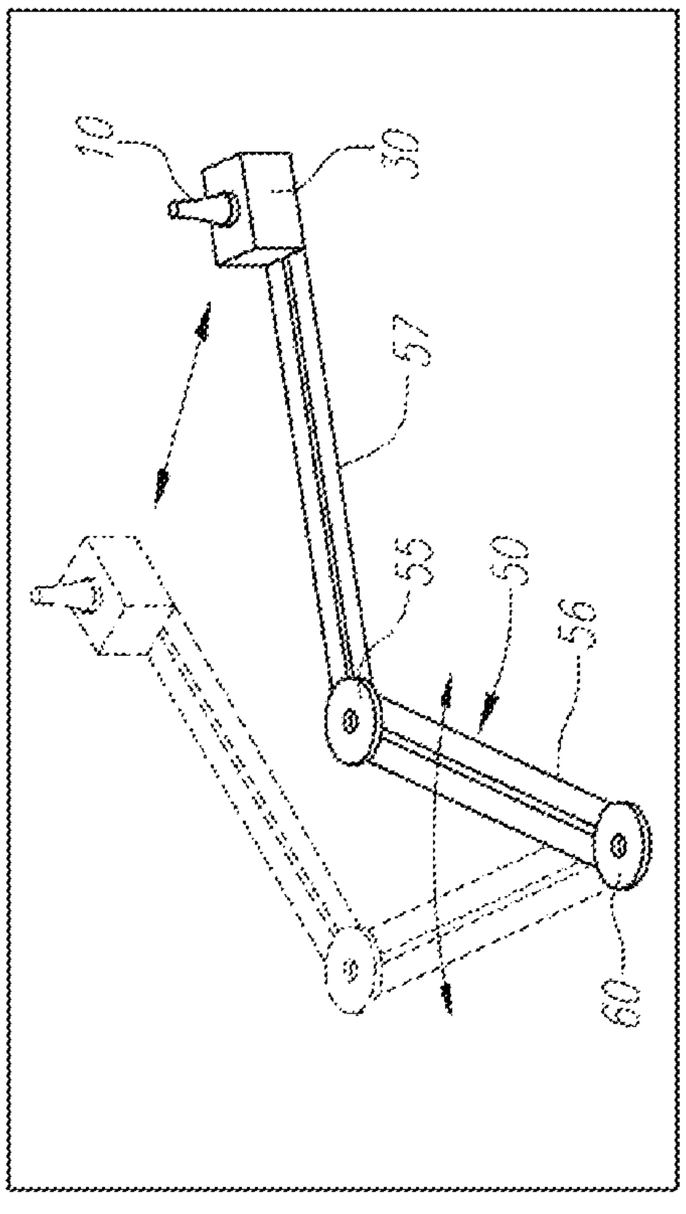


FIG. 3B

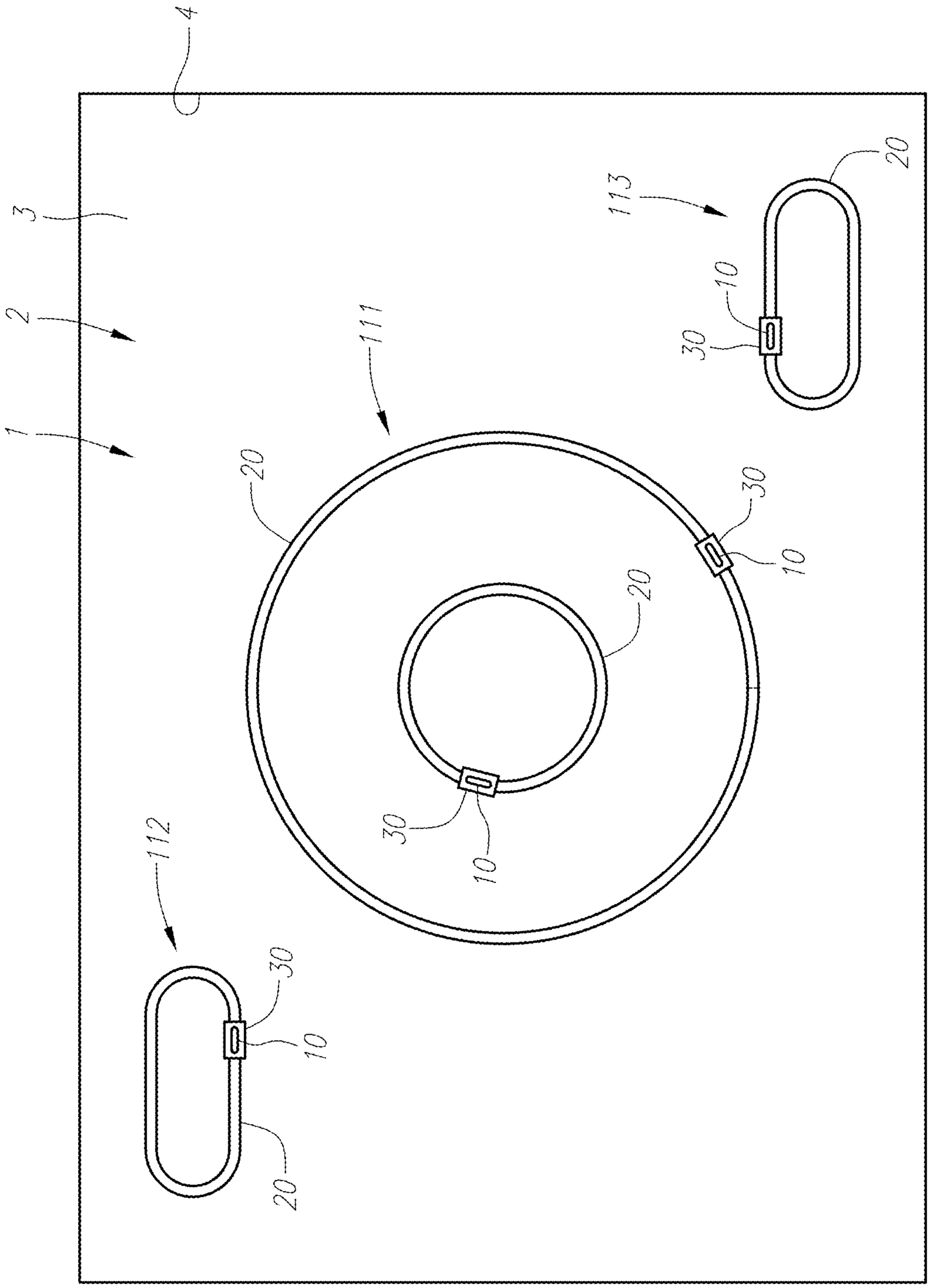
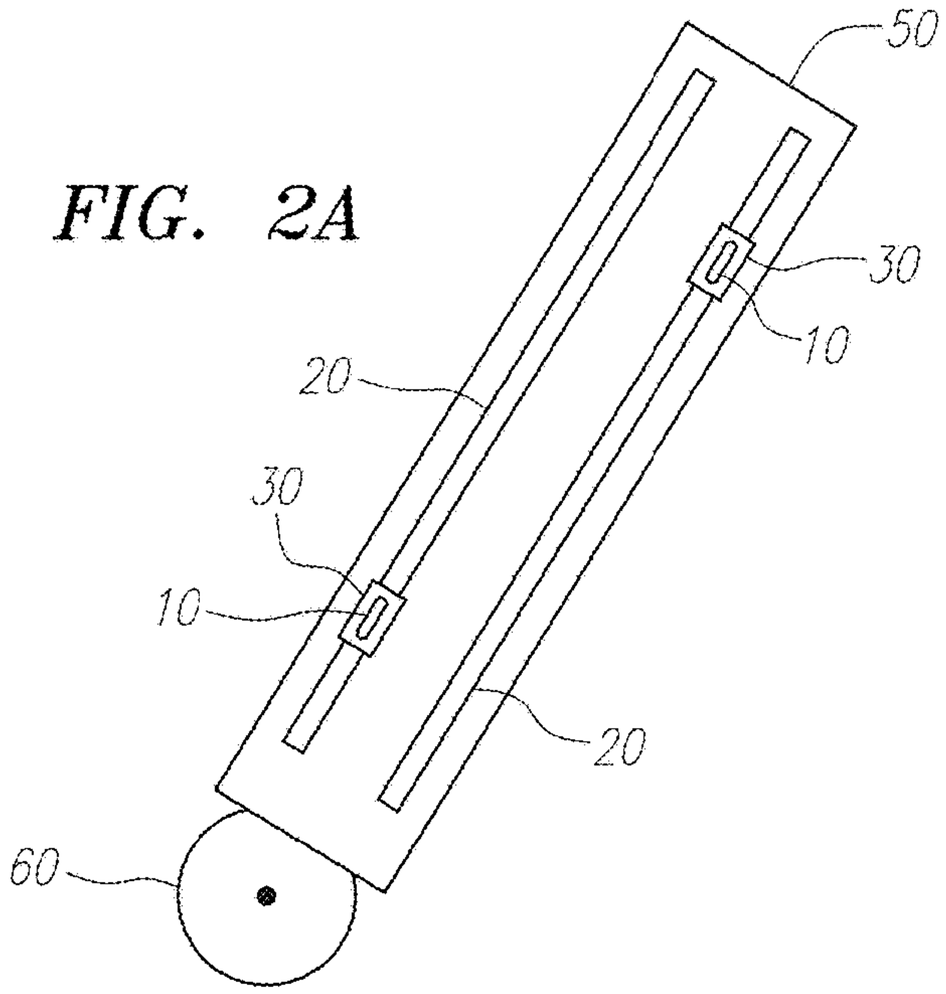


FIG. 1D

FIG. 2A



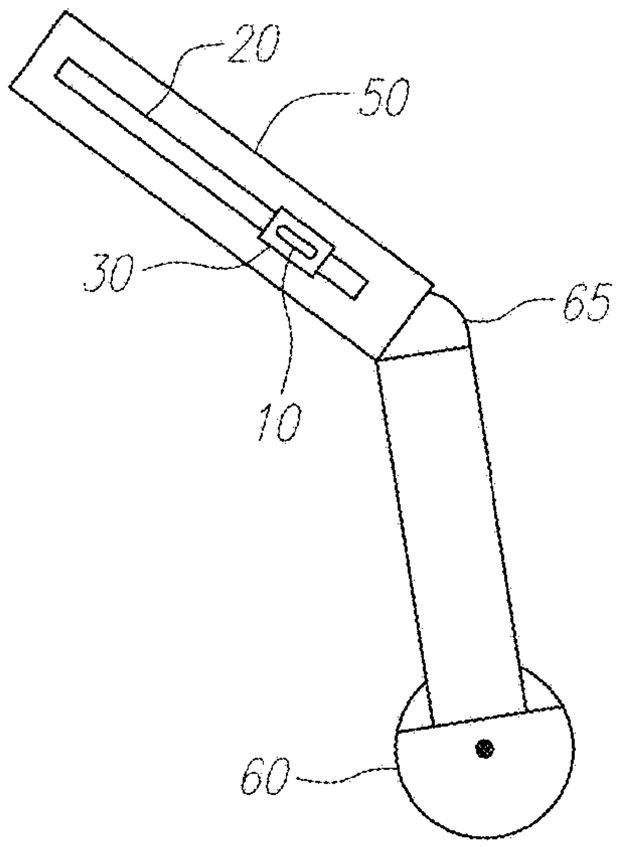


FIG. 3A

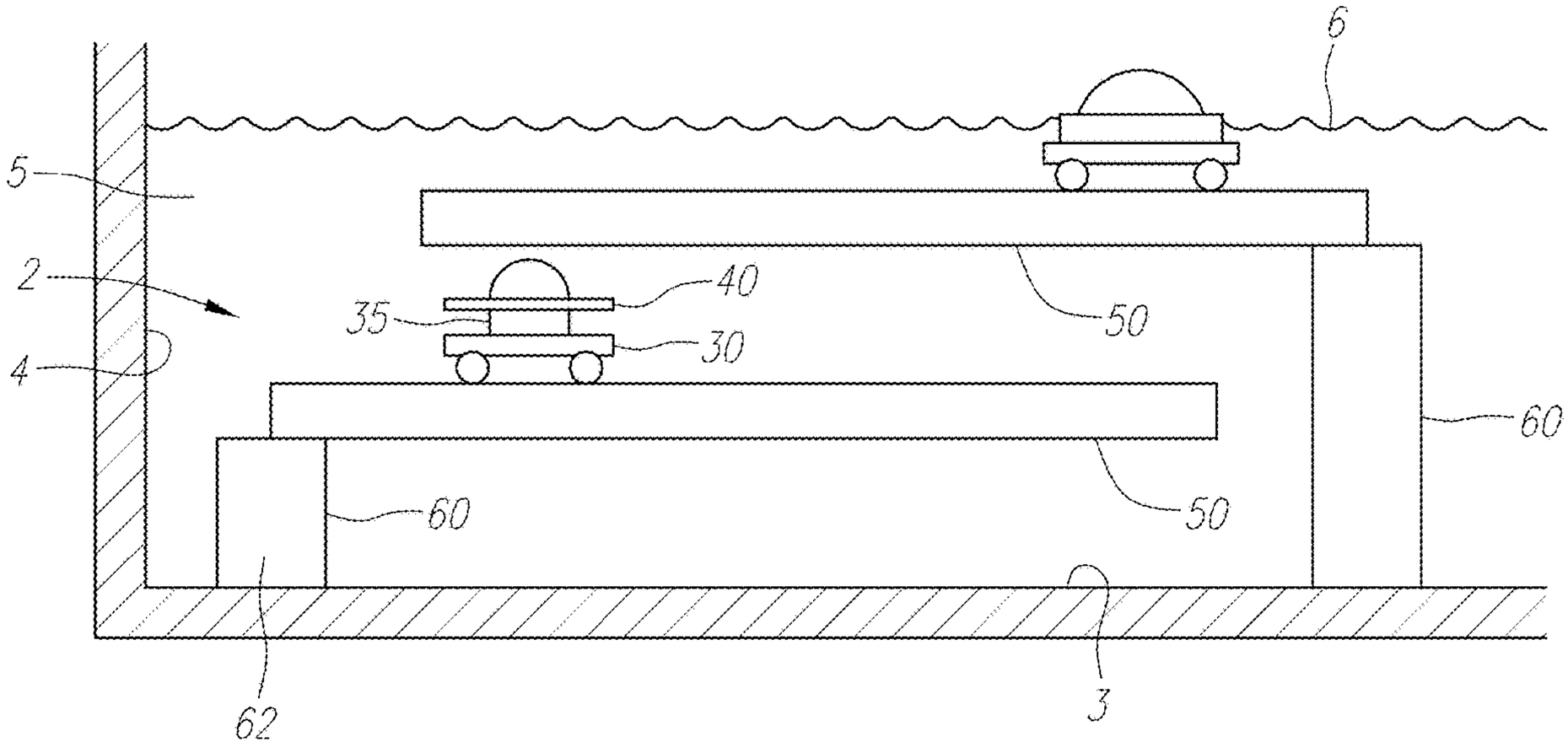


FIG. 2B

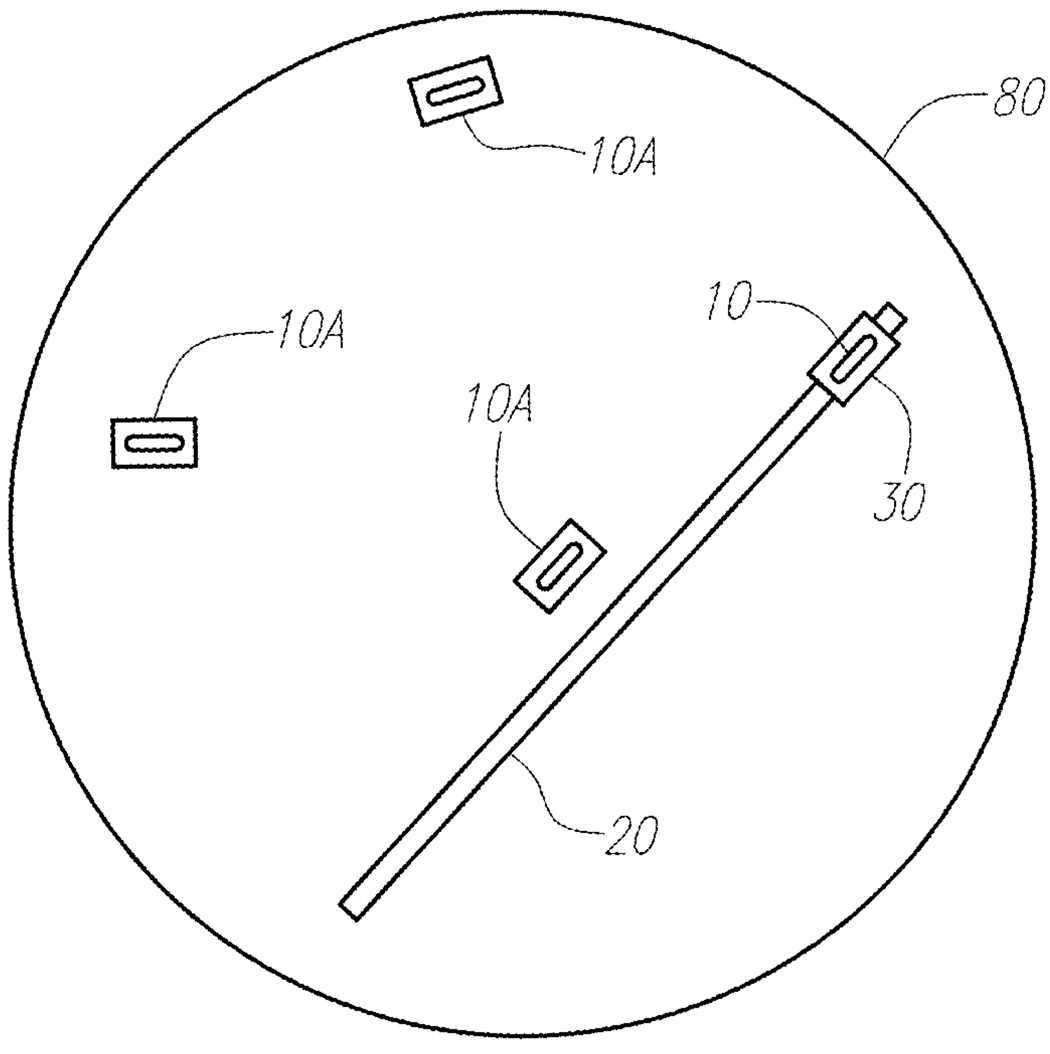


FIG. 4A

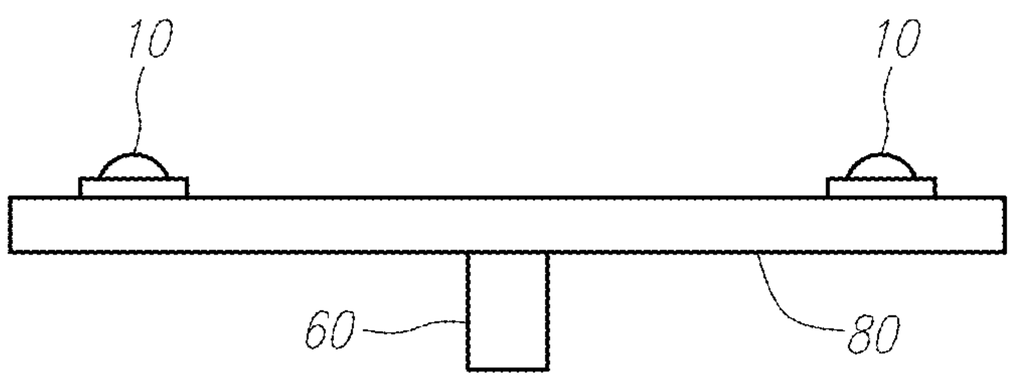


FIG. 4B

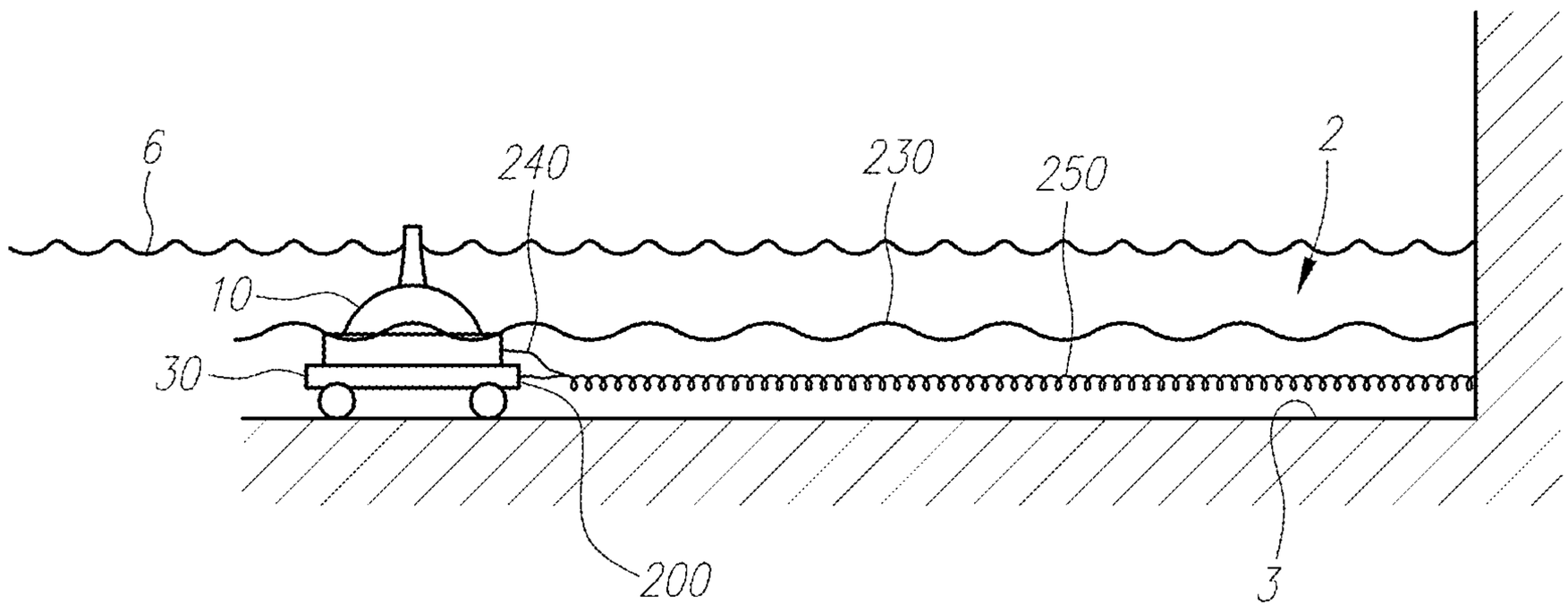


FIG. 5

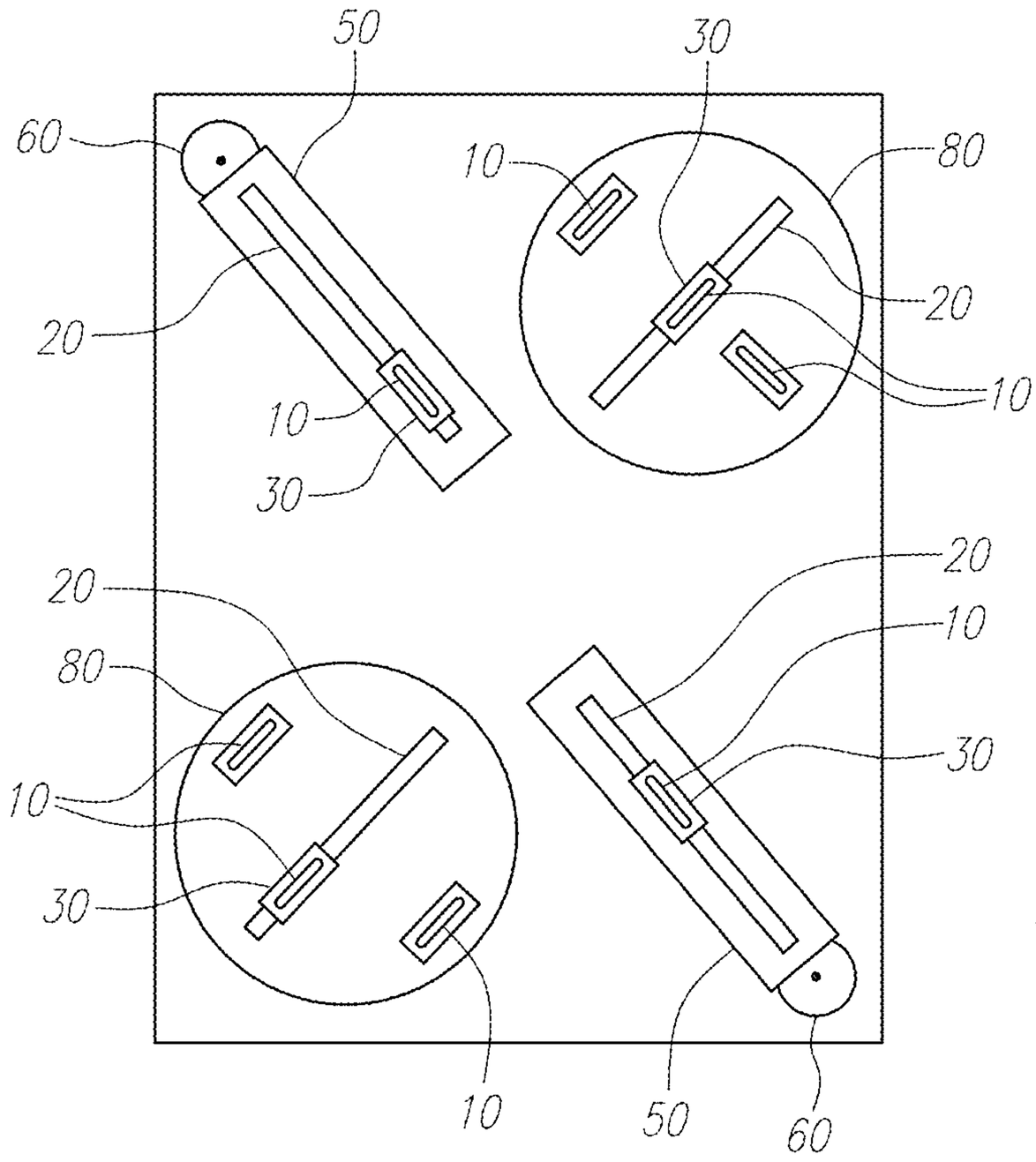

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FIG. 6

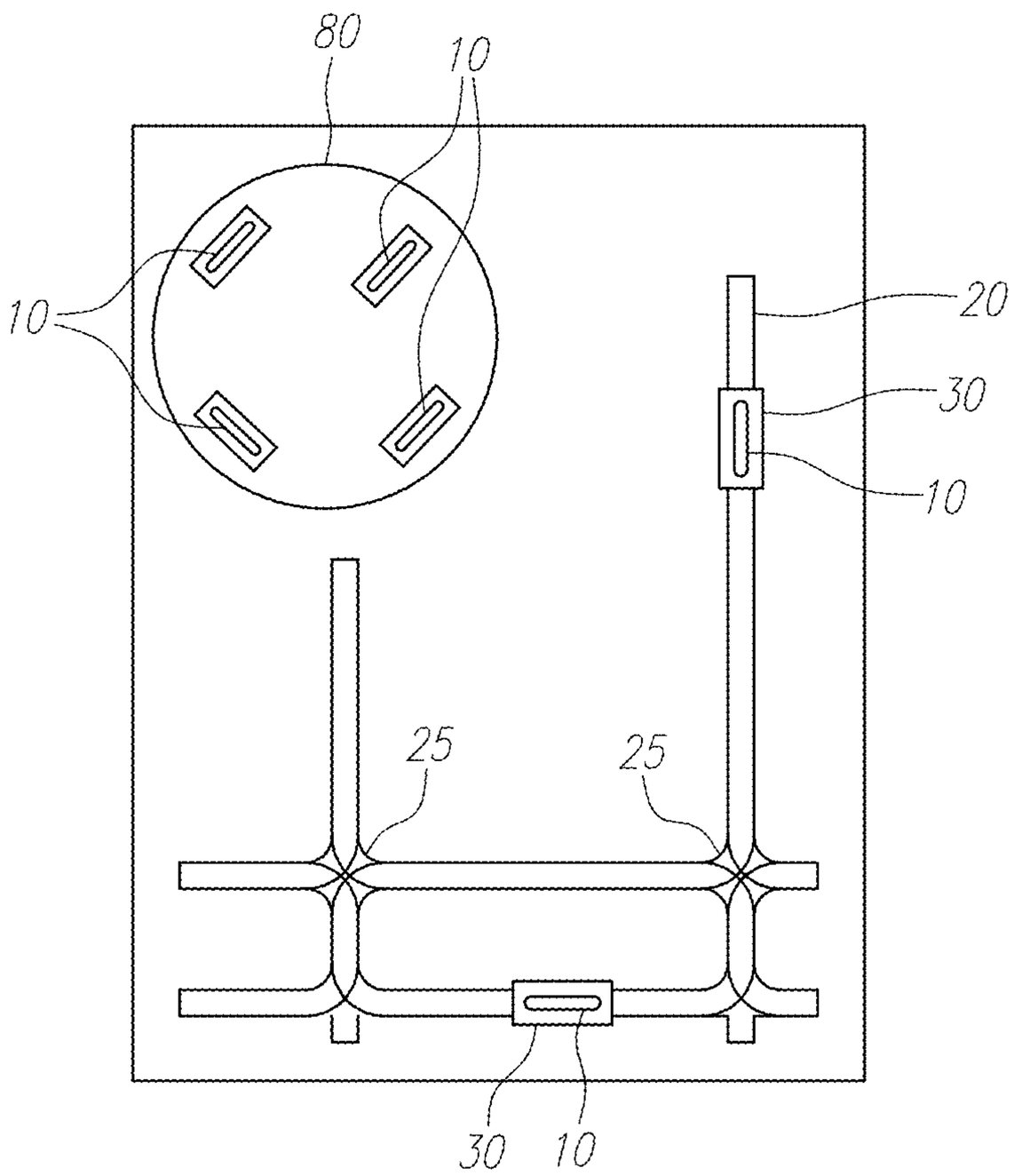
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FIG. 7

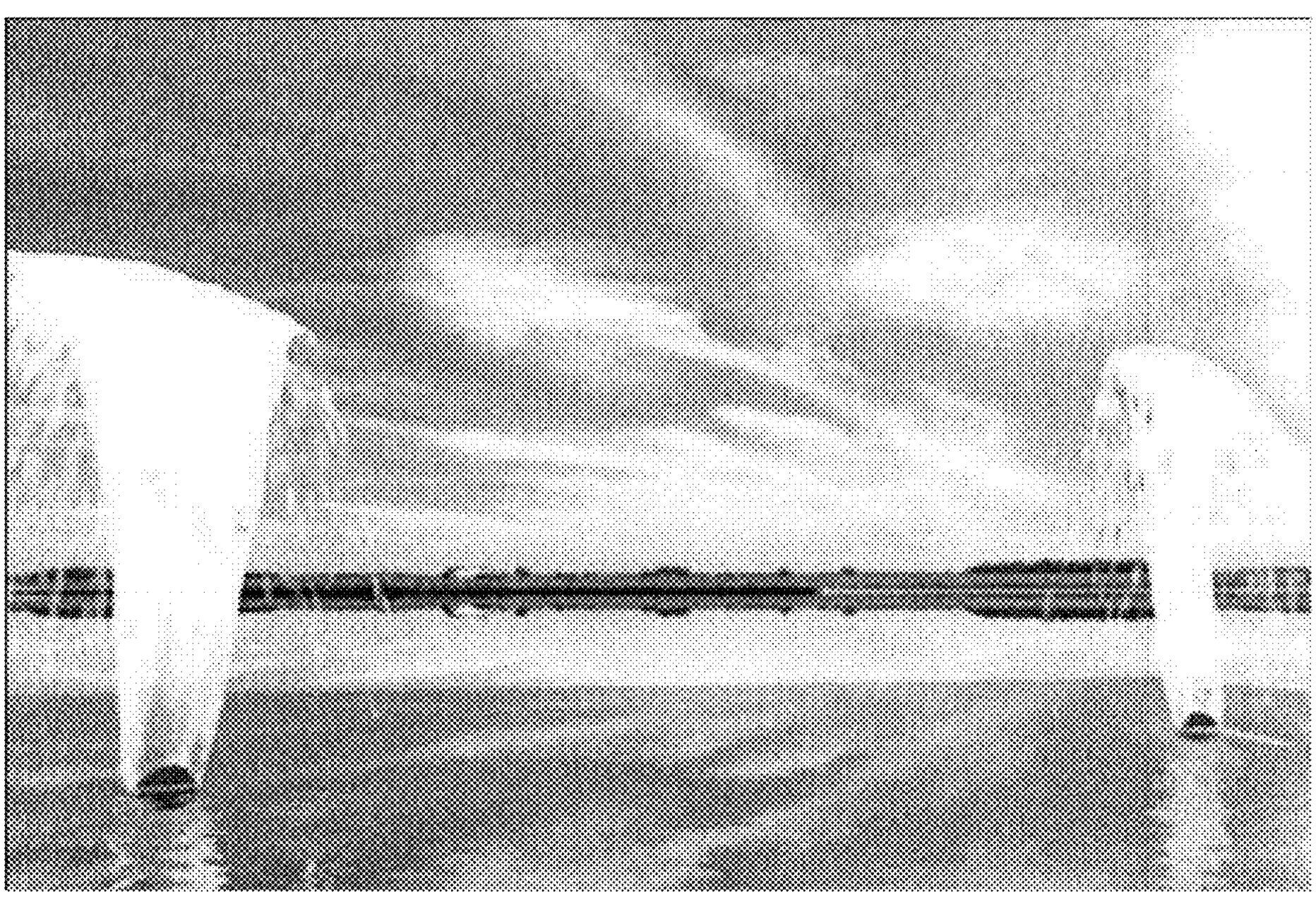

FIG. 8A

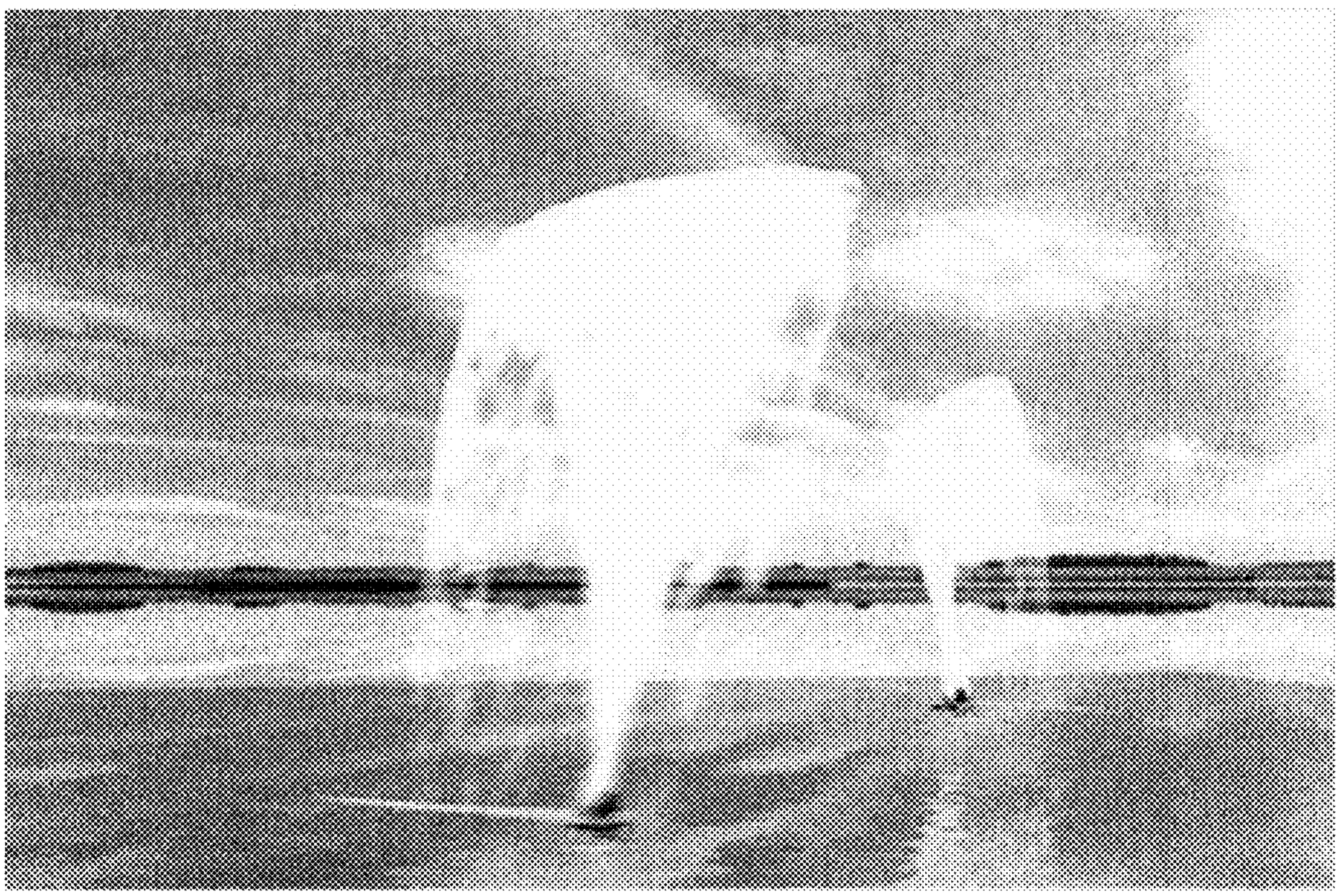

FIG. 8B

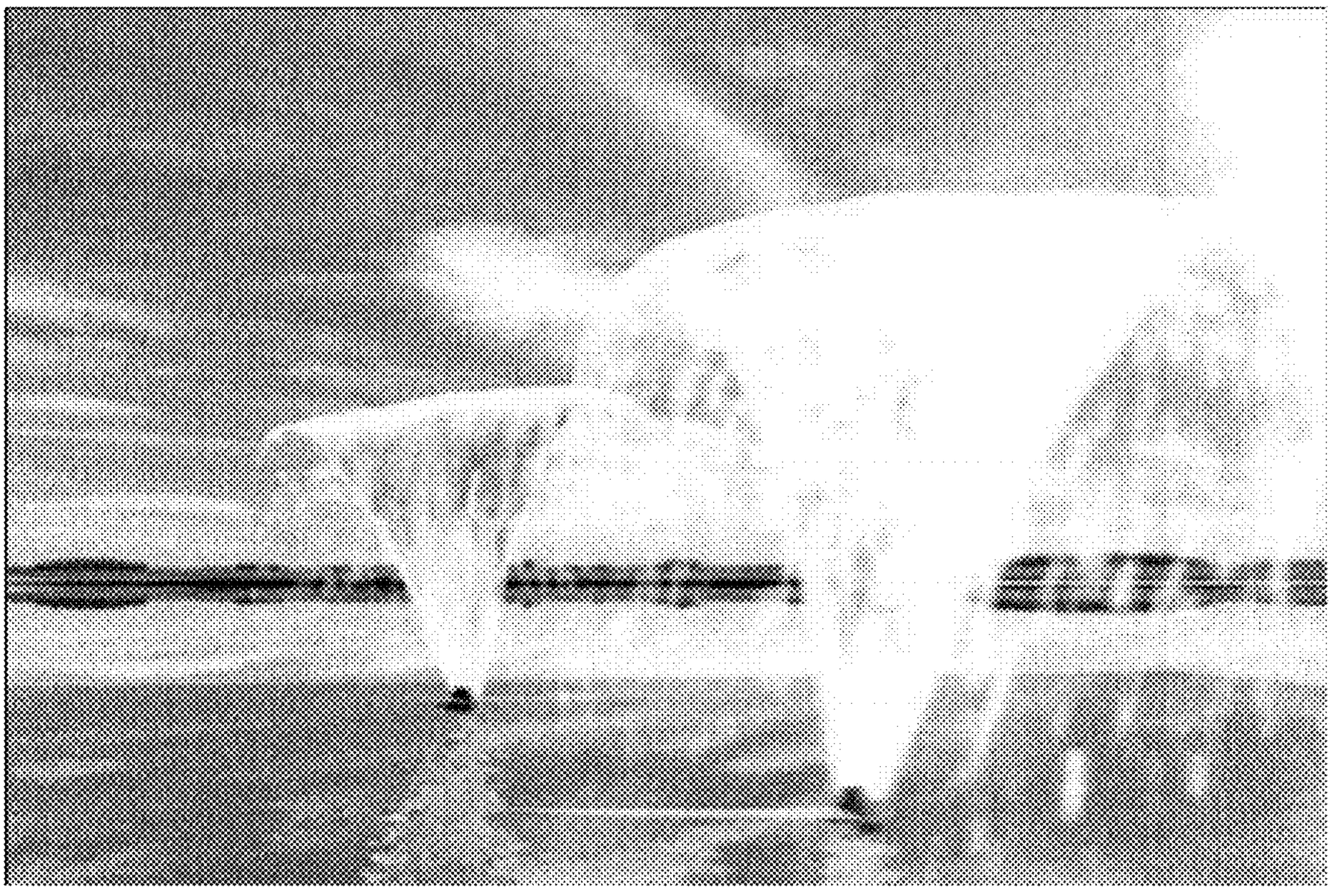

FIG. 8C

FIG. 8D

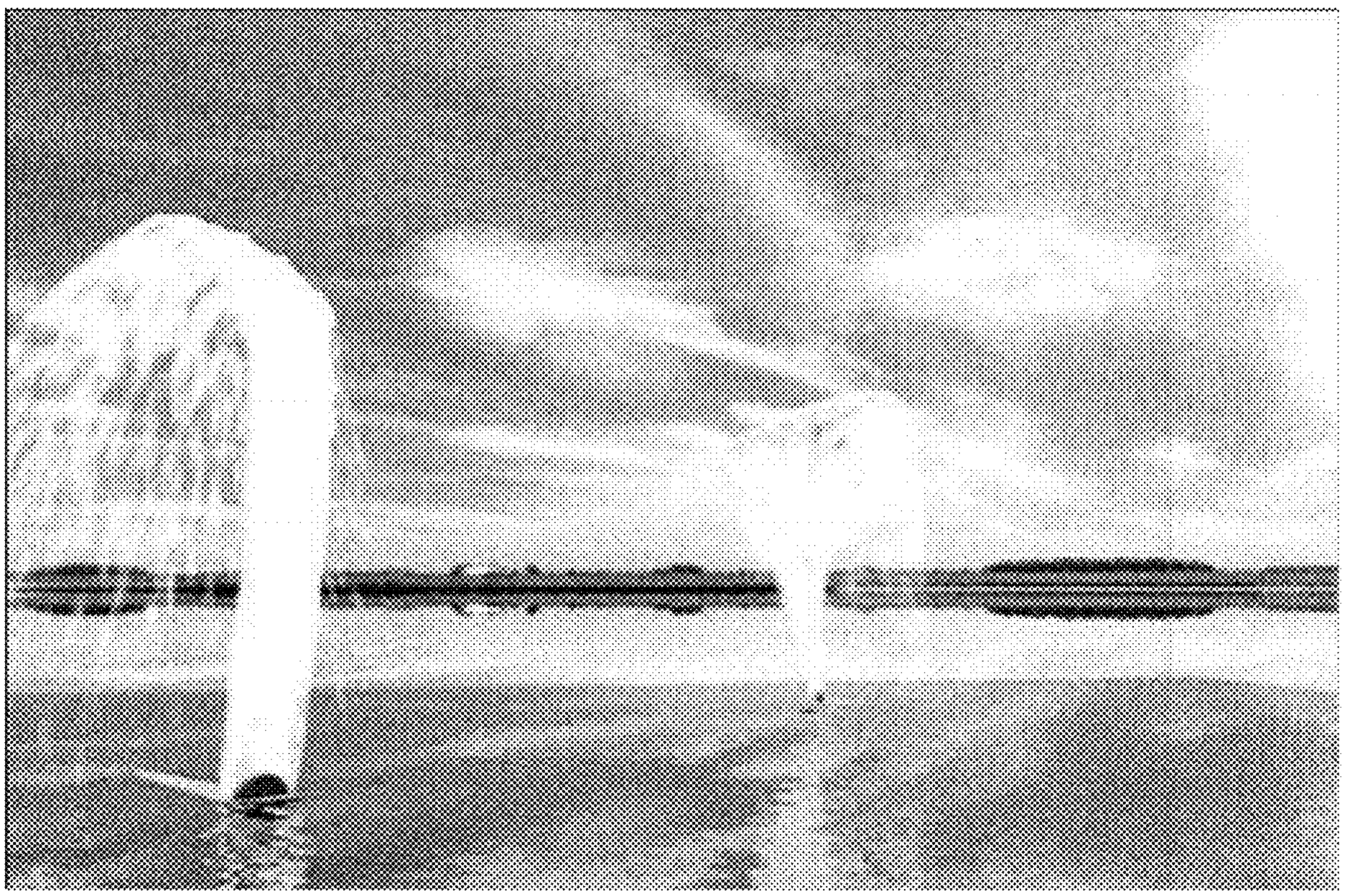

FIG. 8E

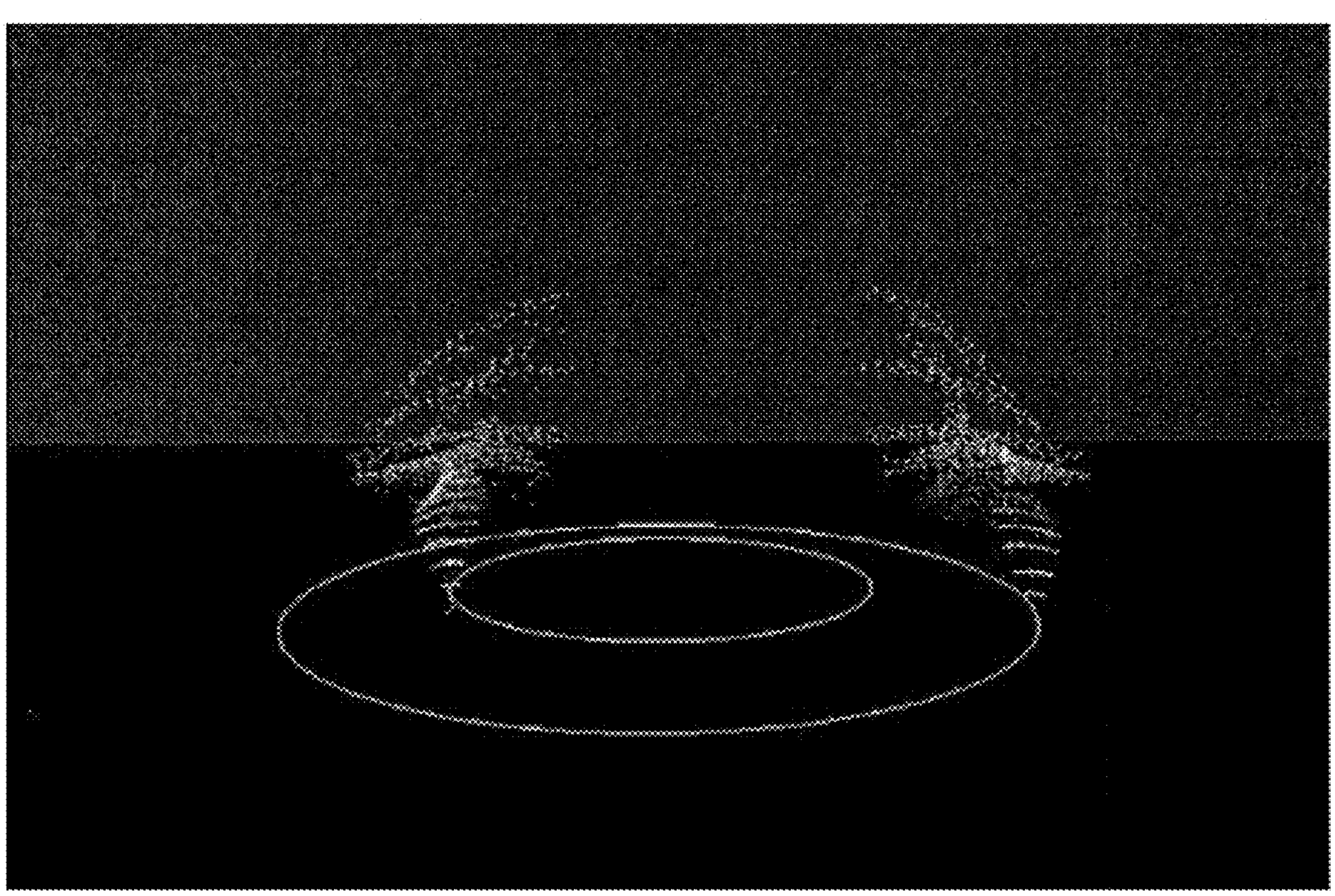

FIG. 9A

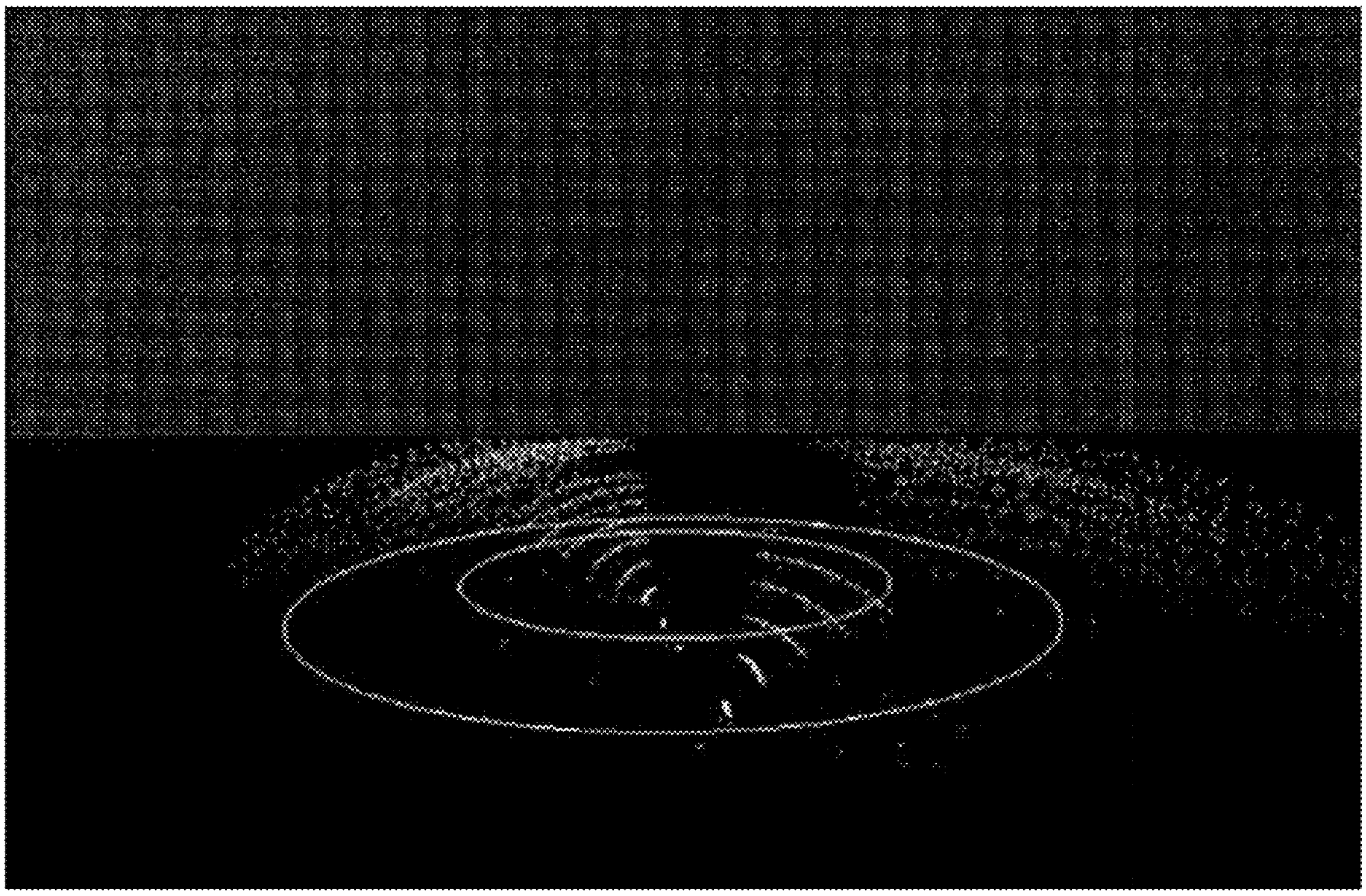

FIG. 9B

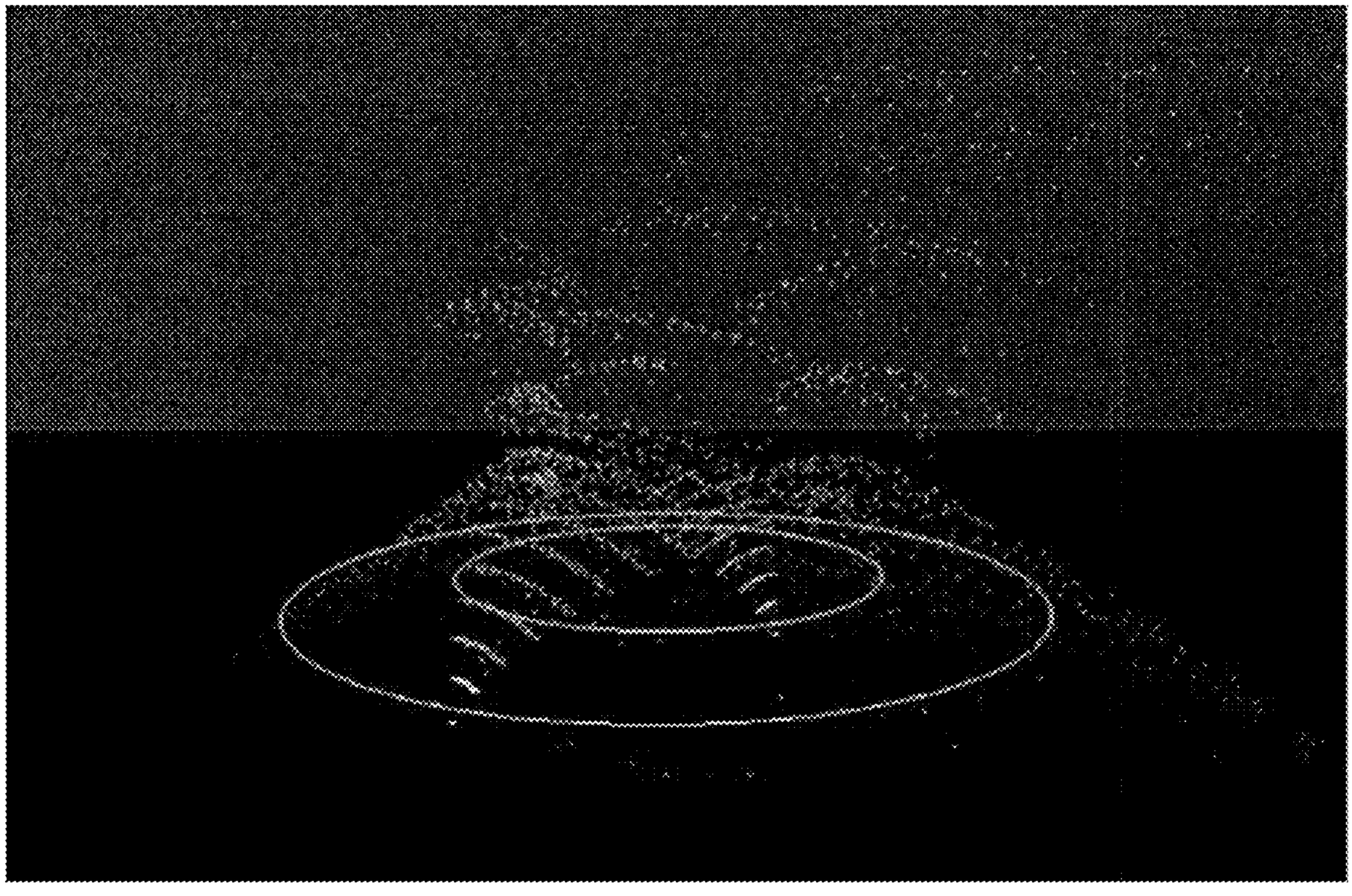

FIG. 9C

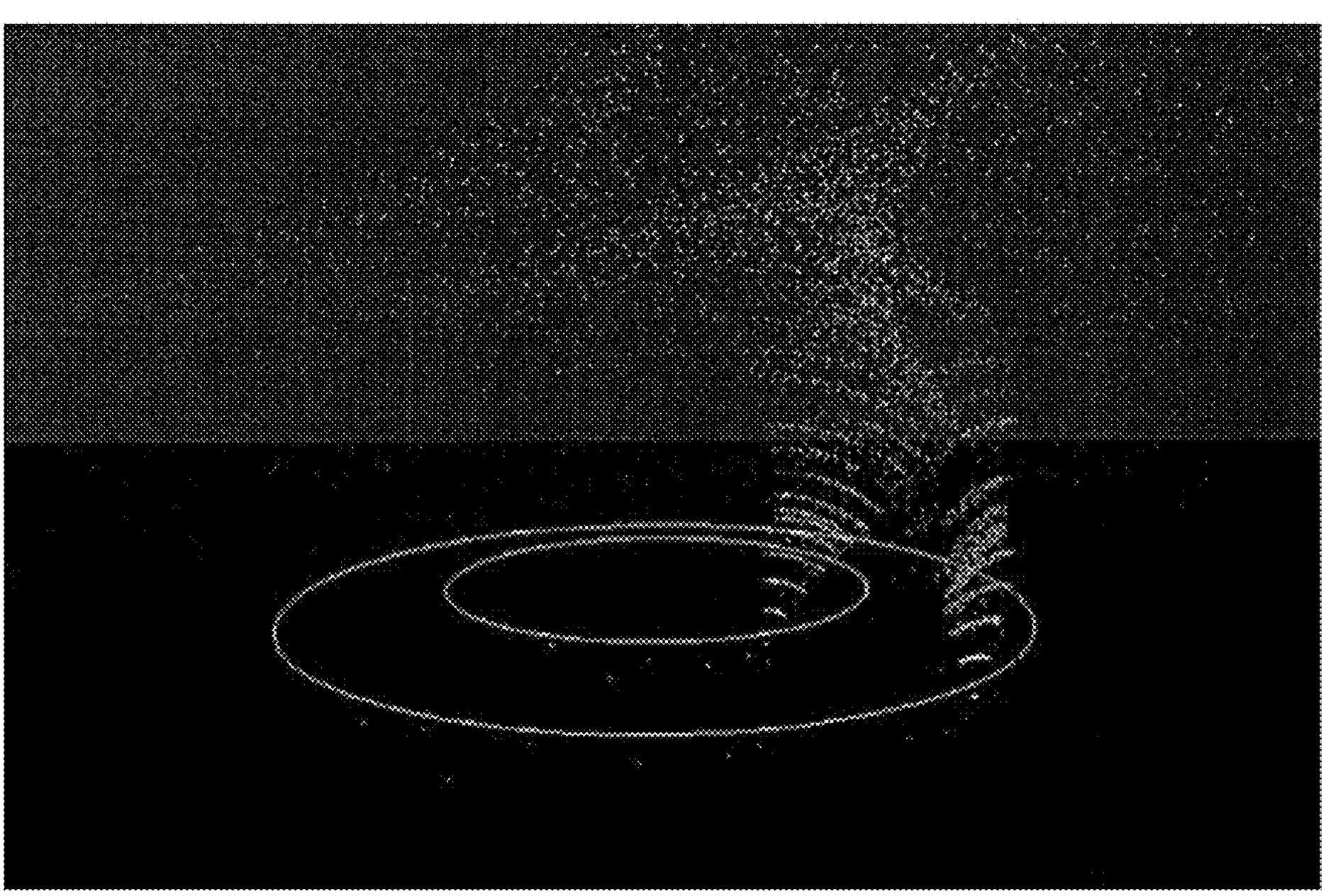

FIG. 9D

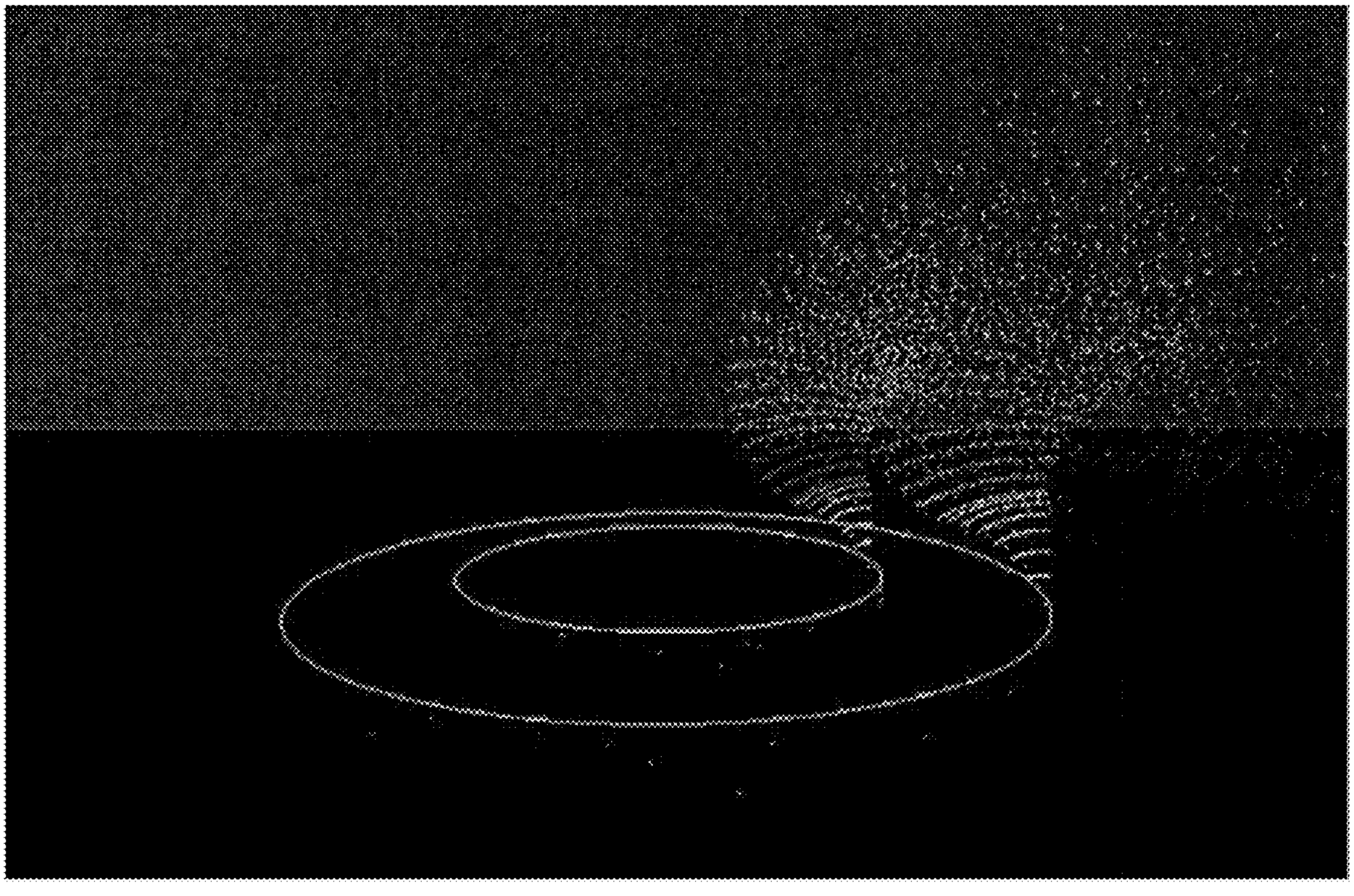

FIG. 9E

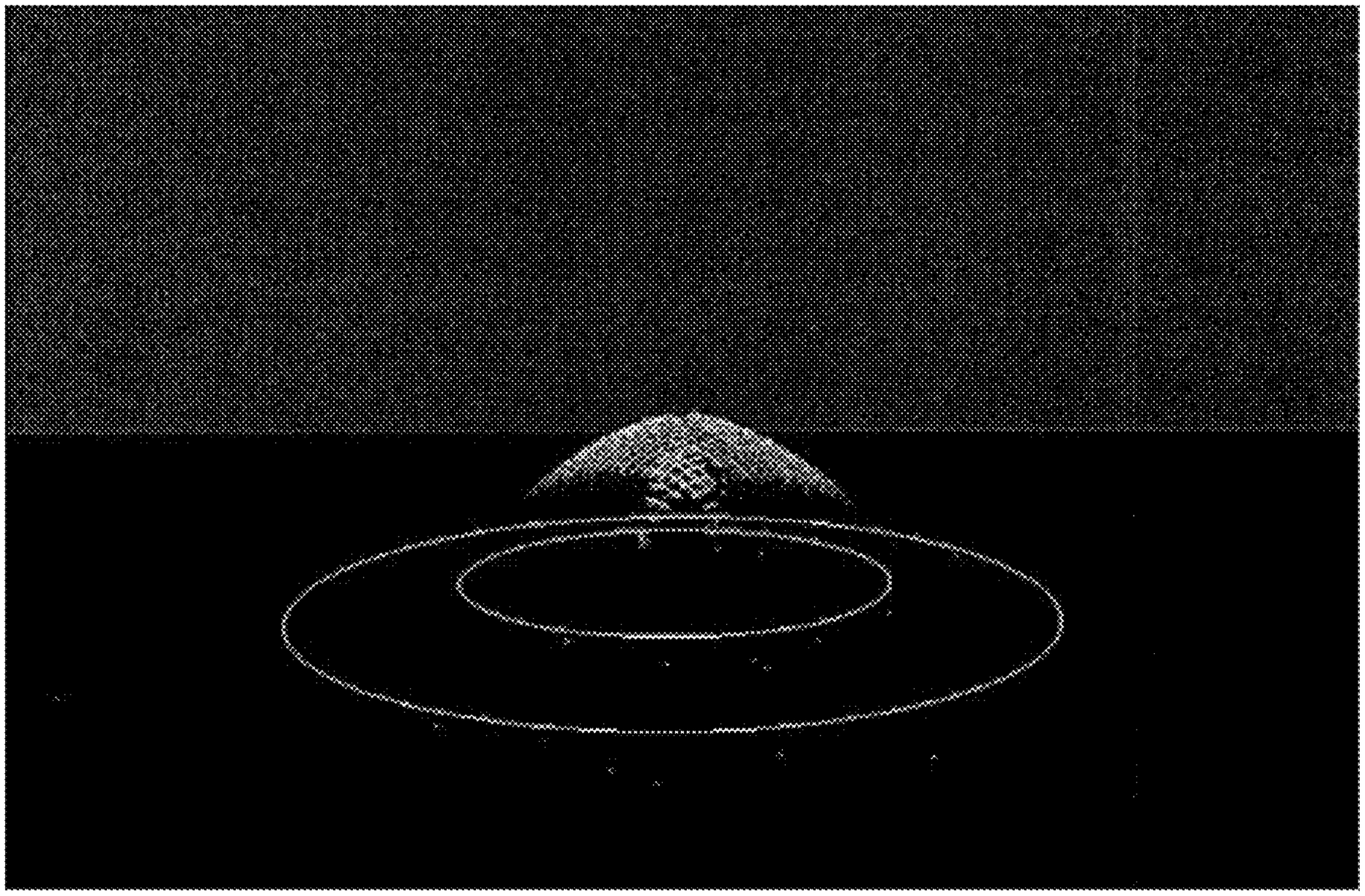

FIG. 9F

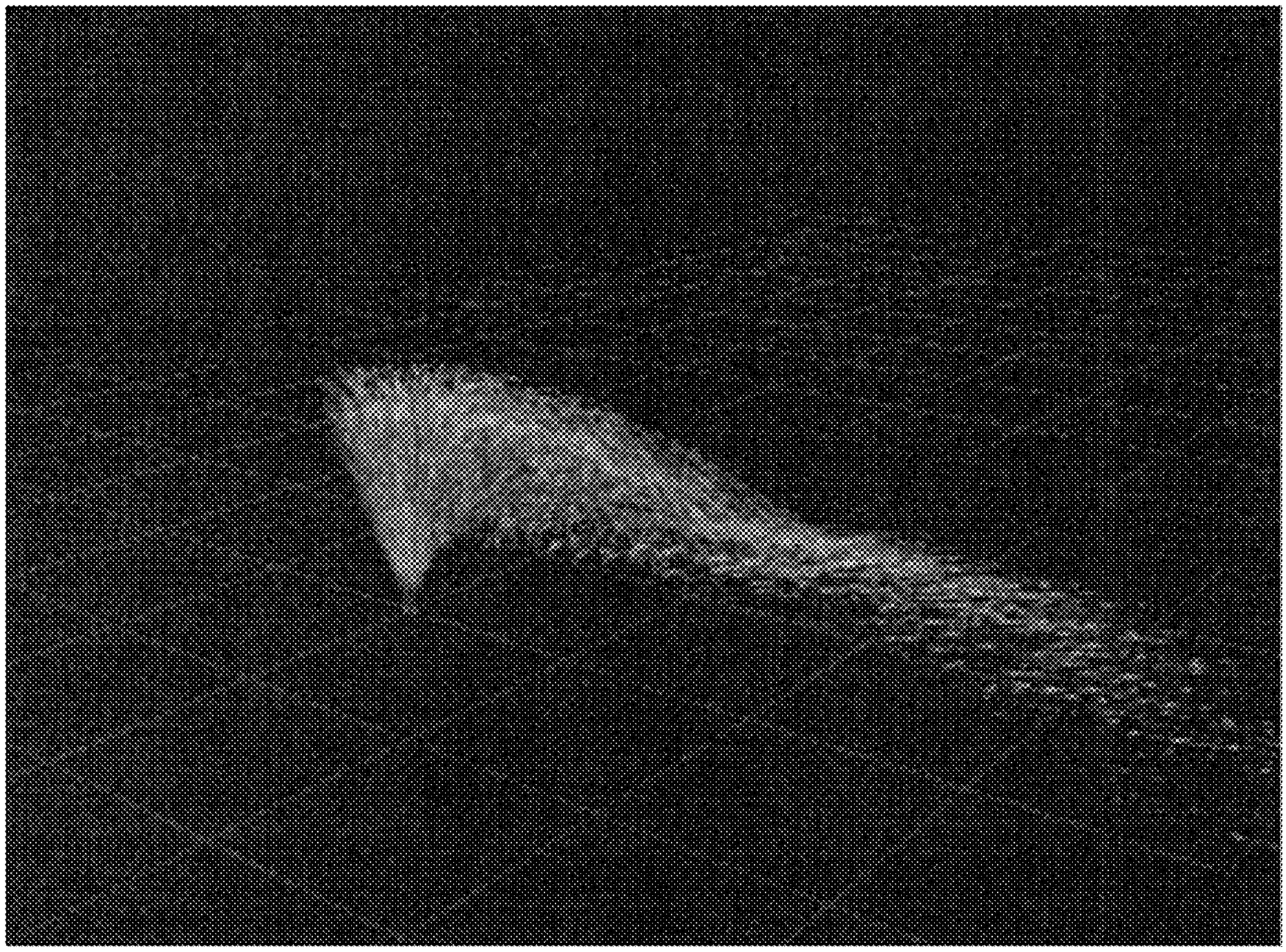

FIG. 10A

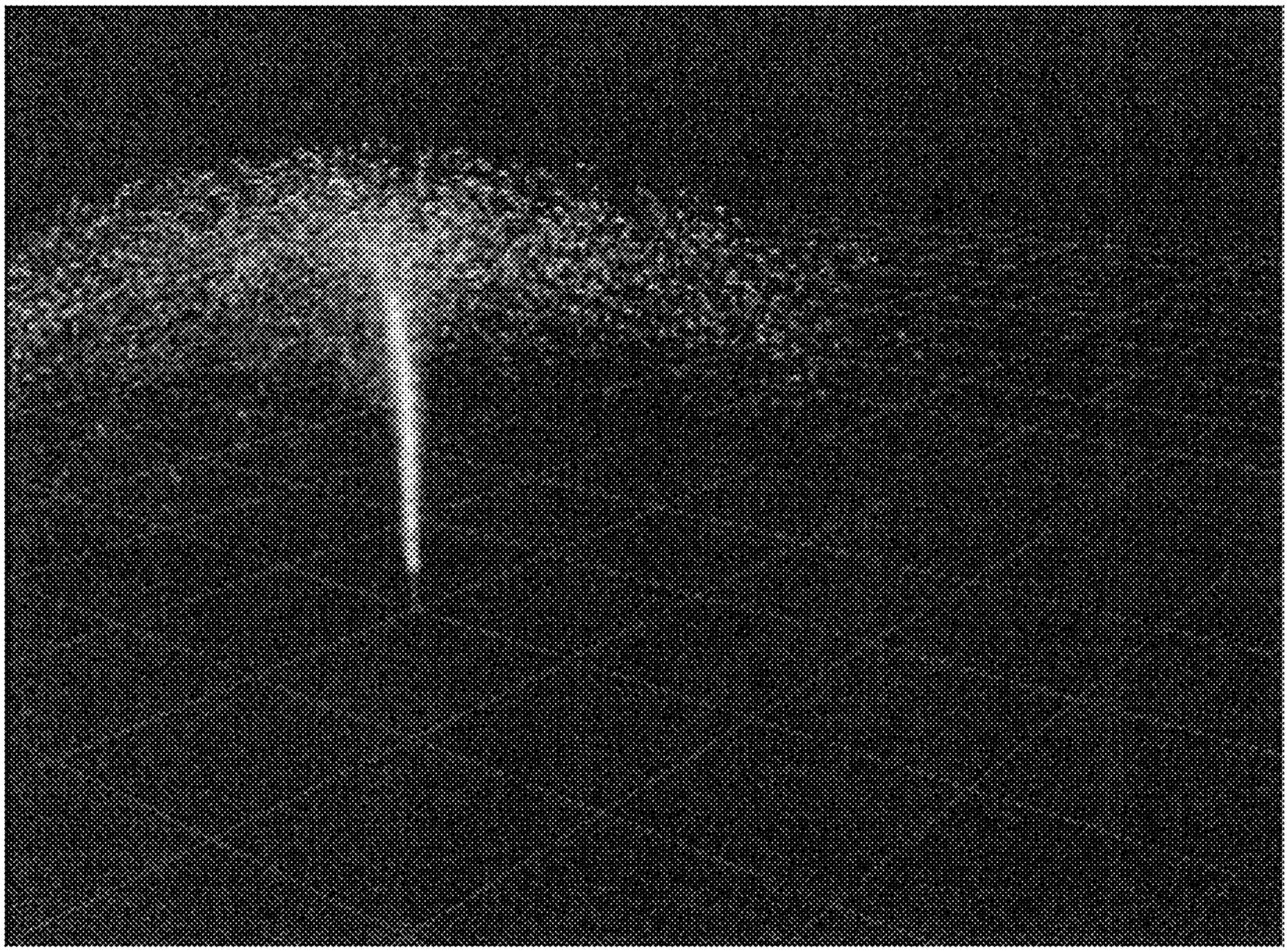

FIG. 10B

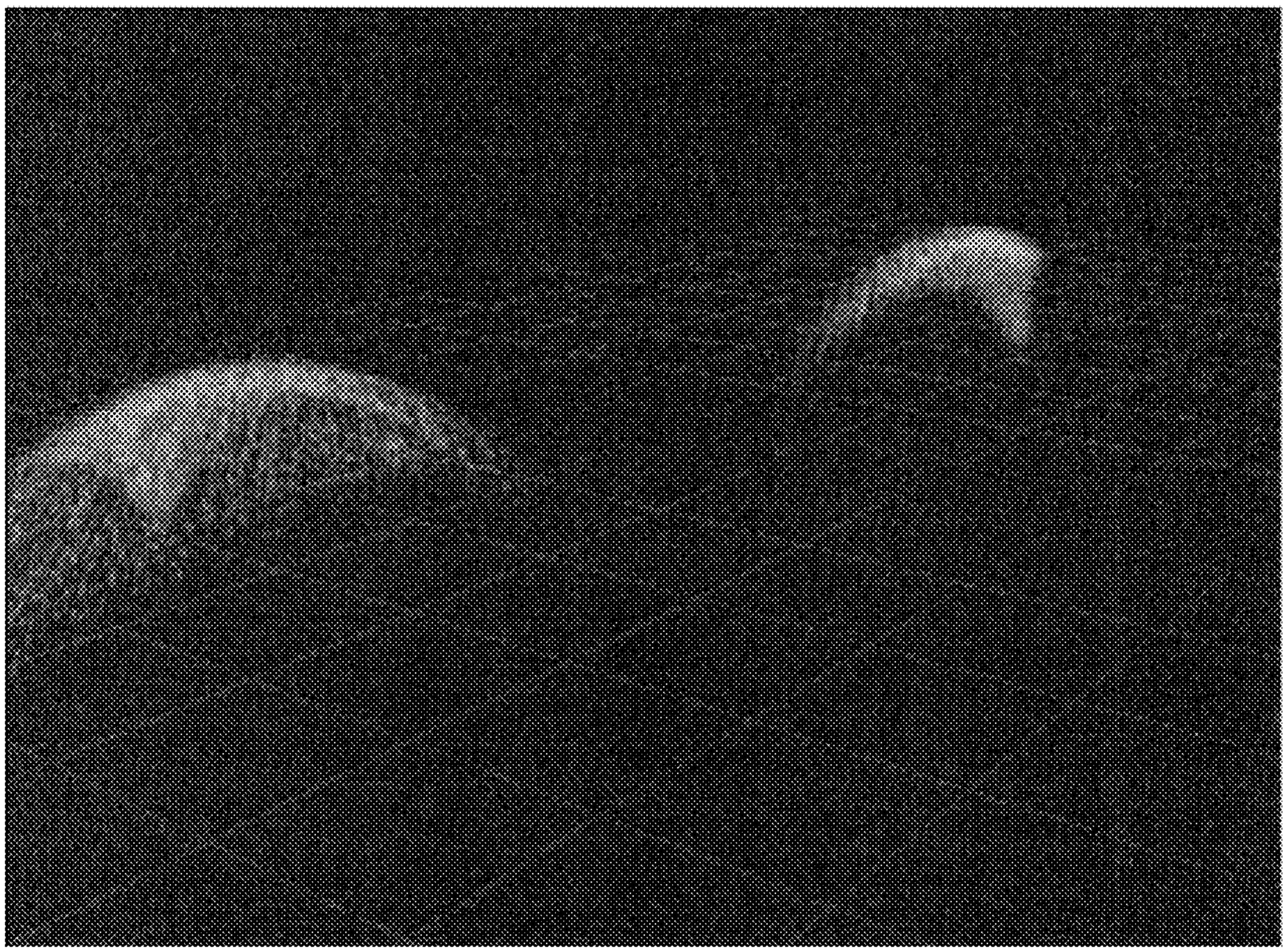

FIG. 10C

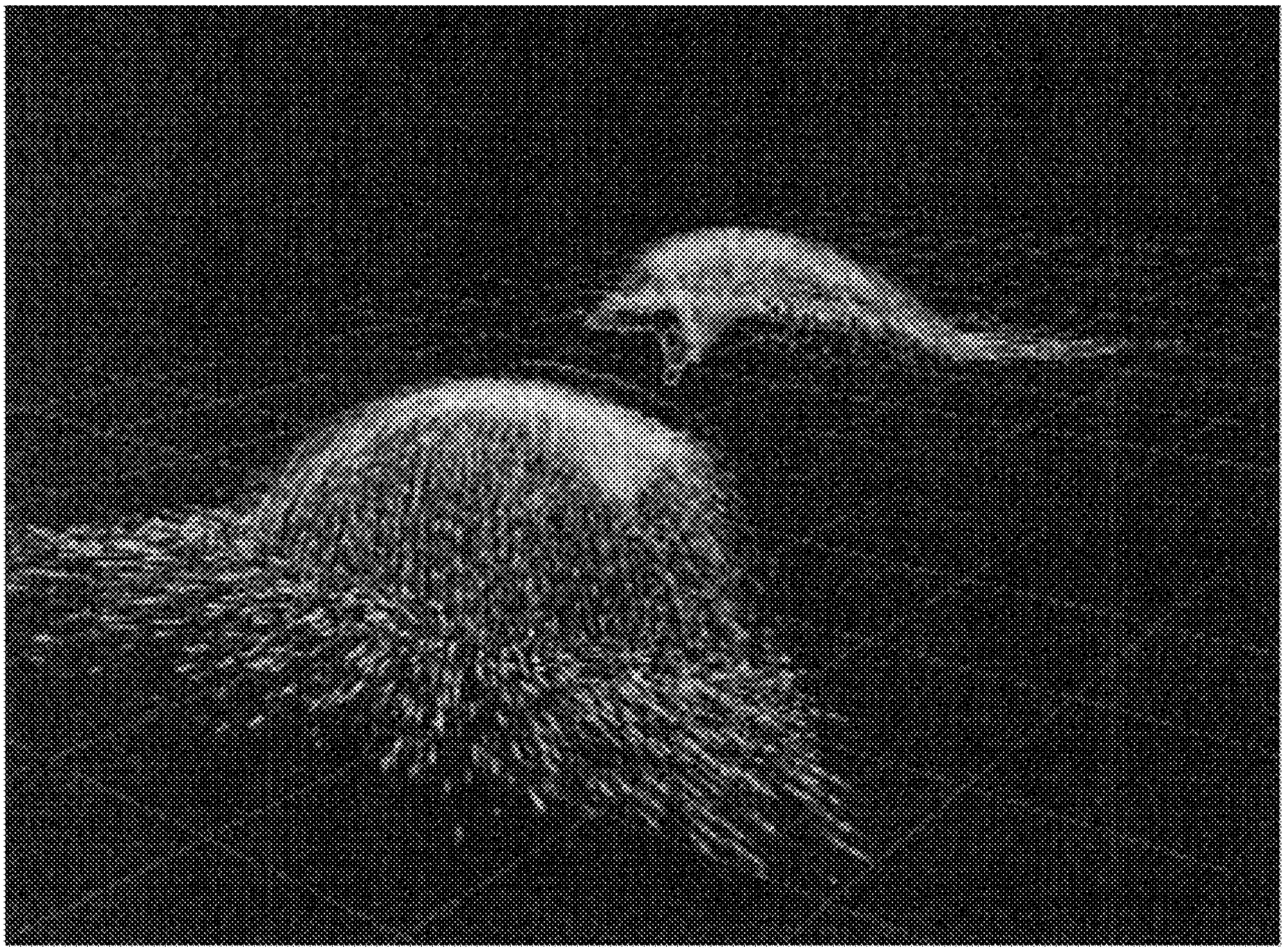

FIG. 10D

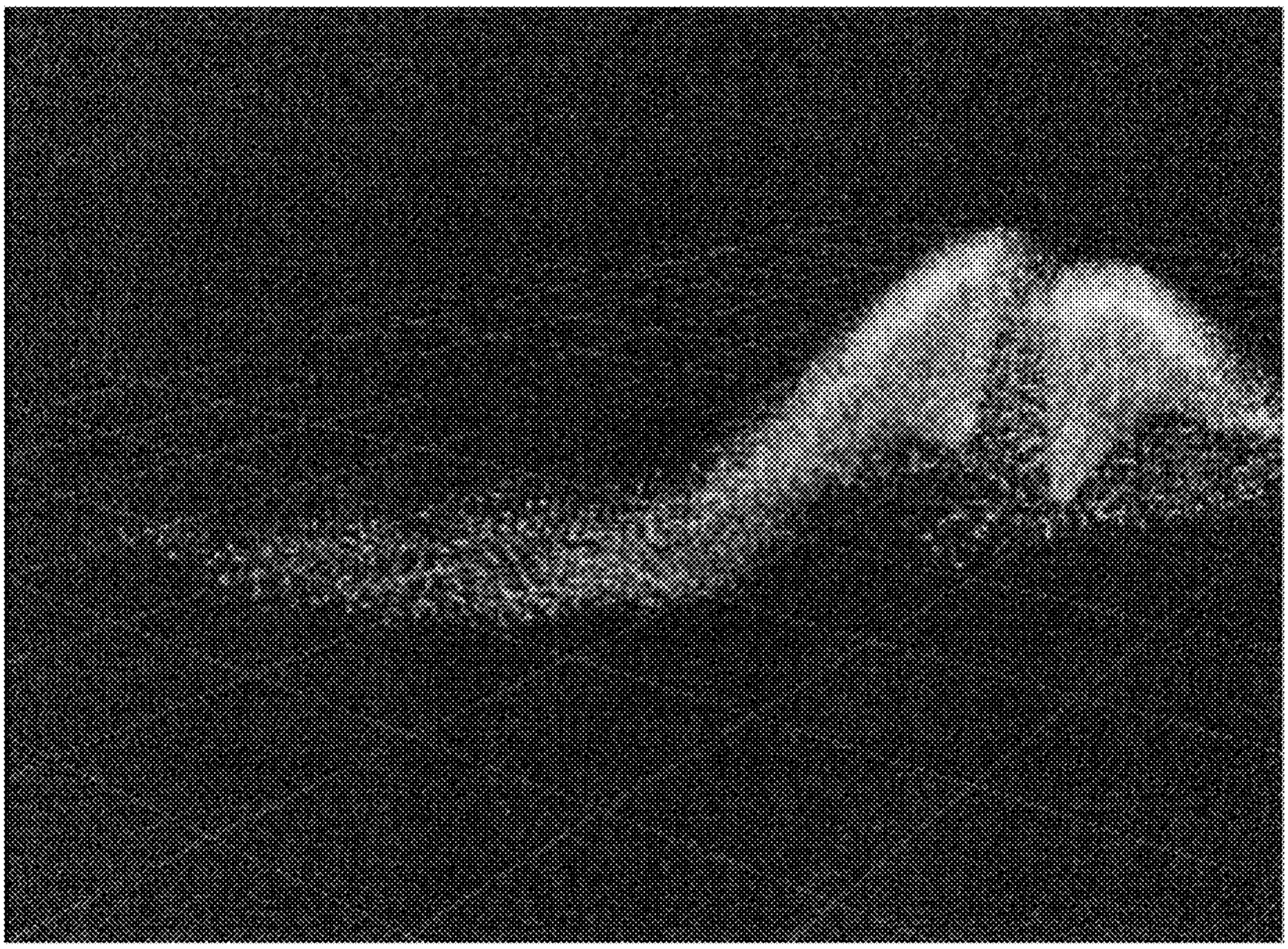

FIG. 10E

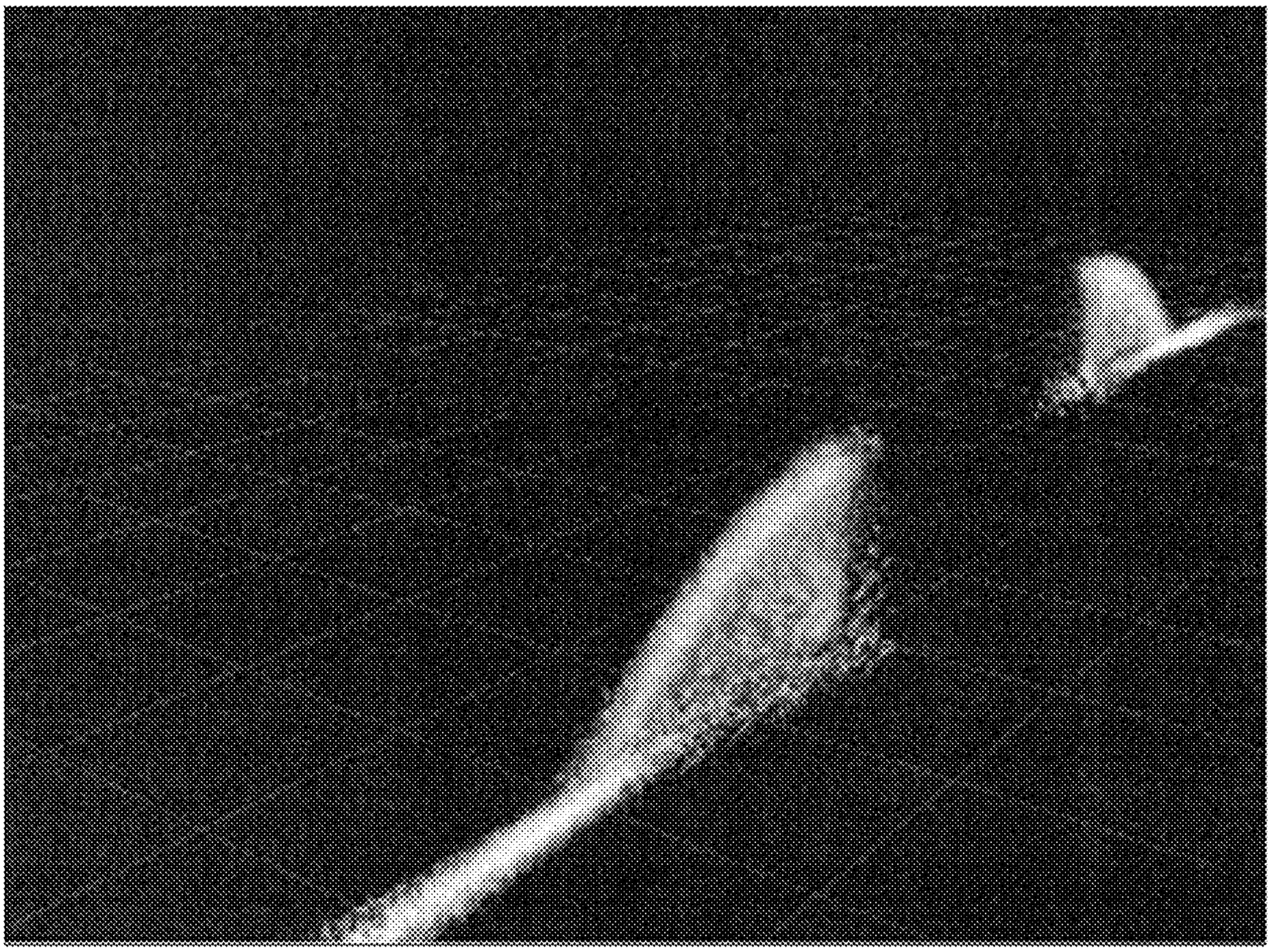

FIG. 10F

TRAVELING WATER DELIVERY DEVICE

CROSS REFERENCE TO RELATED APPLICATION

The application claims the benefit of U.S. Provisional Application No. 61/801,871, filed Mar. 15, 2013, the contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention generally relates to water displays and water delivery devices used in such display, including a water delivery device that may move during the performance of the water display.

BACKGROUND OF THE INVENTION

Various types of water displays exist, and many of them include various types of water delivery devices that shoot water into the air. Oftentimes, the water display is located in a reservoir having a floor and walls. Before the reservoir is filled with water, a network of water delivery devices may be attached to the bottom of the reservoir. This may include the water delivery devices themselves, as well as supporting lines such as electrical, water supply and other lines. After the reservoir is filled, water generally surrounds the water delivery devices, but the outlet of the water delivery device typically remains above the reservoir water level.

These existing water delivery devices may provide dramatic visual effects, but if they are fixed to the bottom of the water reservoir, there is some limitation of the visual effects they can produce. For example, fixed water delivery devices typically cannot provide the appearance of a stream of water that moves to different locations in the reservoir.

Many current fountains are described as "dancing fountains" which tends to imply that the fountain dances or moves about. However, this is an overstatement in that even the most limited human dancer moves in some form across the performance stage, whereas existing water delivery devices and nozzles, robotic or otherwise, are affixed to the ground or pool bottom and move, if they move at all, about that fixed point.

Accordingly, there is a need for a water delivery device for use in a water display that may move to provide the appearance that the water stream ejected by the device is actually moving. There is also a need for a water display having water delivery devices that may be moved during the visual display to allow water shooters to perform effects from various locations in the reservoir.

SUMMARY OF THE INVENTION

In an aspect of the current invention, a water display is described that include one or more water delivery devices that move around the display reservoir and provide the appearance that they are moving. In an embodiment described herein, a water delivery device may be mounted to a moving trolley device that travels either along a track or prescribed path, or is free moving, such as a small controllable underwater vehicle. The water delivery device may itself be movable and not need to be attached to a separate trolley for movement. That is, water delivery device may itself have wheels or other means to engage a track, boom or other means which may allow the water delivery device to travel. In this manner, the water delivery devices may move around the reservoir.

In another aspect of the current invention, several types of tracks are described. These may include a gridded track system, tracks that represent concentric circles, a boom which may rotate and on which a water delivery device may translate inward and outward radially along the boom, a rotating platform, a gimbaled arm and other types of tracks.

In another aspect of the current invention, a trolley that is not attached to any type of predetermined grid is described. This may resemble a free swimming device where the path of the water delivery device may be independent of any grid.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a top view of the gridded track system.

FIG. **1**B is a side view of the gridded track system.

FIG. **1**C is a perspective view of another gridded track system.

FIG. **1**D is a top view of a circular track system configuration.

FIG. **2**A is a top view of the rotating boom track.

FIG. **2**B is a side view of the rotating boom track.

FIG. **2**C is a perspective view of the rotating boom track.

FIG. **3**A is a top view of the rotating boom track with a pivot point.

FIG. **3**B is a perspective view of the rotating book track with a pivot point.

FIG. **4**A is a top view of the rotating platform configuration.

FIG. **4**B is a side view of the rotating platform configuration.

FIG. **4**C is a perspective view of the rotating platform configuration.

FIG. **5** shows a free swimming trolley configuration.

FIG. **6-7** show examples of possible displays incorporating multiple configurations.

FIGS. **8**A-**8**E is a series of pictures showing the visual effects provided by water delivery devices traveling along a circular track.

FIGS. **9**A-**9**F is a series of pictures showing the visual effects provided by water delivery devices traveling along concentric circular tracks.

FIGS. **10**A-**10**F is a series of pictures showing the visual effects provided by water delivery devices traveling along a gridded track.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The current invention is now described with reference to the figures. Where the same or similar components appear in more than one figure, they are identified by the same reference numeral. The invention is described herein with reference to water. However, other liquids and combinations thereof are within the scope of the invention.

In general, one or more water delivery devices **10** of the current invention may form part of water display **1** that may be housed by pool or reservoir **2**. Pool or reservoir **2** may include floor **3** and walls **4**. After pool **2** is filled with water **5**, pool **2** generally has a water surface **6**. As discussed later, FIGS. **8**A-**8**E, **9**A-**9**F and **10**A-**10**F show examples of different displays **1** in reservoir **2** where the water delivery devices **10** move around. But prior to discussing the display's moving appearance, the structure is first described.

In a first embodiment, a gridded track system **100** is described with reference to FIGS. **1**A, **1**B and **1**C. As shown in FIG. **1**A track system may comprise tracks **20** and one or more trollies **30** that may move along tracks **20**. Water

delivery devices **10** may be mounted on trolley **30** and thus move about reservoir **2**. Alternatively, device **10** may be movable in and of itself. In general, tracks **20** and trollies **30** may be submerged in reservoir **2**. Water delivery device **10** may also be submerged except for its nozzle that may extend above the water surface **6** so that water shots may occur.

An example of water delivery device **10** is more fully described in U.S. Provisional Application Ser. No. 61/739,667, filed Dec. 19, 2012, the contents of which are expressly incorporated by reference as if fully set forth herein. Other examples of water shooter **20** that may be provided by WET Design, Inc. are described in the following article, the contents of which are expressly incorporated by reference as if fully set forth herein: *Making Water Dance*, Jan. 9, 2003, Machine Design.com. The article may be found at: http://machinedesign.com/article/making-water-dance-0109.

In the embodiment of FIG. **1**A, track system **100** includes two separate track networks **102**, **104**. Network **102** shows two sets of tracks on the left and right sides and a single set of tracks at the top and bottom. Network **104** shows a single set of tracks. Though they may not be connected together, networks **102**, **104** still preferably allow significant movement by water delivery devices **10** around reservoir **2**.

In any event, track system **100** may comprise any number of tracks **20**, trollies **30** and water delivery devices **10** mounted thereon to provide the desired water display effects. Water shooter **40** may be attached to moving trolley device **30** such that water shooter **40** is partially submerged in the water reservoir providing water to water shooter **40** to produce water display effects.

Trolley **30** is now further described. As shown in FIG. **1**B, trolley **30** may include platform **32** and one or more wheels **34**. Water shooter or other water delivery device **10** may be mounted to platform **32**, and wheels **34** may be movably coupled to tracks **20**. It is preferred that device **10** may be securely mounted to platform **32** to resist recoil from a water shot out device **10**. Suitable attachment means such as brackets, bolts and other means may be used.

Similarly, it is preferred that trolley **30** be securely coupled to tracks **20**. To this end, trolley **30** may include a pair of front wheels **34** and a pair of rear wheels **34**. In one embodiment, wheels **34** may engage tracks **20** similar to how train wheels engage train tracks.

Trollies **30** may preferably move about the grid system **100** so that they may travel the length of track **20**, make turns and return. Trolley **30** may be propelled by various means such as, but not limited to, electric motors, pneumatic propulsion or hydraulic propulsion which may involve using the water **5** of reservoir **2**.

Tracks **20** and trollies **30** may comprise materials that are sustainable in water or some other fluid environment. For example, the material comprising tracks **20** and trolleys **30** may be treated to provide water resistance or covered with water resistant material where gridded track system **100** is placed in reservoir **2** containing water.

As shown in FIG. **1**A, track system **100** may also include switching devices **25** so that one trolley **30** may pass another trolley **30** while both are on the same set of tracks **20**. Switches **25** may be incorporated into track **20** to allow one moving trolley **30** pass a stationary moving trolley device **30** on the same track **20**. Switches **25** may be comprised of components and technology of traditional railroad switches used commonly throughout the world and may consist of, but is not limited to, single slip switches, double slip switches or crossovers.

Track system **100** may also include other means for allowing moving trollies **30** to pass each another. For example, one line of track **20** may be designed to pass underneath another line of track **20** such that trolley device **30** and water shooter **40** may be momentarily submerged in the reservoir (not shown). In this embodiment, the lower track **20** is positioned far enough below the upper track **20** so that the height of trolley **30** and shooter **10** accommodated. Here, the device **10** may be turned off prior to it submerging and after it passes under the upper track **20**, it may then emerge above the water surface **6** and perform another water shot. Switches **25** may be used with the upper/lower track configuration to facilitate travel of moving trollies **30**.

Another embodiment for grid track system **100** is shown in FIG. **1**C. Here, parallel tracks **21** may extend for some length of reservoir **2**. Tracks **21** may be single tracks. Double track **22** may extend between tracks **21** and may also support trolley **30** and water delivery device **10**. In this embodiment, trolley **30** may move back and forth along double track **22** while double track **22** may move back and forth along single tracks **21**. These two degrees of movement may provide significant movement for device **10** around reservoir.

Water delivery device **10** may also be mounted to trolley by a gimbal **12** so that additional visual effects may be provided as trolley **30** moves. That is, shooter **10** may move in the directions shown by the arrows. So while shooter **10** moves about reservoir **2**, it may eject a stream of water that may tilt, etc.

Another embodiment of track system **100** involving circular tracks **20** is now described with reference to FIG. **1**D. As shown, display **1** may reside in reservoir **2**. Display **1** may comprise track networks **111**, **112**, **113**. Network **111** may include two circular tracks **20** arranged in a concentric arrangement. Networks **112**, **113** may be configured in ovals as shown. In any event, various types of networks having curved sections may be used, and the current invention is not limited to circles and ovals. Any number of water shooters **10** may be attached to moving trolley devices **30** on any of these networks.

Another embodiment of track system **100** involving a rotating boom **50** is now described with reference to FIGS. **2**A and **2**B. As shown in FIG. **2**A, rotating boom **50** may be attached at one end to pivot **60**. Boom **50** may include tracks **20** on which trollies **30** may travel. Water delivery devices **10** may be mounted to trollies **30** in the same manner discussed above. One or more sets of tracks **20** may be attached to rotating boom **50**, and one or more moving trolley devices **30** containing water shooters **10** may travel on tracks **20**. In general, boom **50**, pivot **60**, tracks **20**, trolley **30** and most of device **10** may be submerged.

Rotating boom **50** may be attached to pivot or rotation device **60** at one end. Rotation device **60** may rotate rotating boom **50** while trollies **30** may travel along the length of boom **50**. This provides several degrees of movement for water delivery device **10** across reservoir **2**.

FIG. **2**B shows a side view of rotating boom **50**. As shown, rotating booms **50** may be supported by pivots **60** which may in turn be mounted to the reservoir floor **3**. Where multiple rotating booms **50** are present, and it is desired that their path intersect, one boom **50** may be mounted lower in reservoir **2** than the other boom **50** so that they do not hit each other when their paths intersect.

However, because the nozzle of the lower device **10** should still extend above the water surface **6** when performing water shots, device **10** or trolley **30** may include an elevation device **35** that may allow water shooter **10** to be lowered when upper boom **50** and lower boom **50** coincide. To this end, elevation device may typically extend the nozzle

of lower shooter **10** above the water surface **6** but may retract it upon intersection of booms **50**. Alternatively, one of the pivots **60** may include an elevation device **62** that lowers boom **50** when upper and lower booms **50** coincide.

It is preferred that the length of boom **50** not overtax the attachment with pivot **60** by providing too excessive a cantilever force. To this end, the length of may be affected by its weight and the forces generated as trollies **30** move along its length. In any event, it is preferred that boom may provide some buoyancy to help support it. Also, the distal end of boom **50** may include a support trolley (not shown) that may travel across the reservoir floor **3**.

Another embodiment involving rotating boom **50** that moves about pivot **60** is now described with reference to FIG. **2**C. As shown, trolley **30** may move along the length of boom **50** as boom **50** rotates. In this embodiment boom support **52** may support the distal end of boom **50**. As shown, additional degrees of movement of shooter **10** may be provided by mounting shooter **10** on a gimbal **12** which is in turn mounted on trolley **30**. As shown by the phantom lines in FIG. **2**C, shooter **10** may assume different positions along the length of boom **50** as boom rotates.

Another embodiment of track system **100** involving a rotating boom **50** that includes a joint so that boom **50** may operate as an articulating arm is now described with reference to FIGS. **3**A and **3**B. As shown, rotating boom **50** may include joint or rotational pivot **65** to provide additional degrees of movement for water delivery device **10**. Though one joint **65** is shown, multiple joints **65** may exist along boom **50**.

Rotating boom **50** with multiple rotational pivots **65** may allow for coverage of a greater area of reservoir **2** and reduce the need for elevation devices **35**. That is, multiple jointed booms **50** may reside in reservoir **2**, and joints **65** may position booms **50** so that they may come close but do not intersect.

Another embodiment of track system **100** of the current invention involving a rotating platform **80** is now described with reference to FIGS. **4**A, **4**B and **4**C. As shown in FIGS. **4**A and **4**B, rotating platform **80** may include tracks **20**, trollies **30**, water delivery devices **10** and rotating device **60**. In one embodiment, rotating platform **80** may include one or more fixed water shooters **10**A without tracks **20** or trollies **30**.

In another embodiment, platform **80** may also or alternatively include tracks **20** which allow one or more moving trollies **30** supporting water shooters **10** to travel along tracks **20** while rotational platform **80** rotates. This provides several degrees of movement for shooter devices **10**. FIG. **4**B shows a side view of rotational platform **80** attached to rotational device **60**. Rotational device **60** may control the rate at which platform **80** rotates. The rate of rotation may coincide with music or other media. FIG. **4**C shows another embodiment of rotating platform **60** where two water shooters are mounted on trollies **30** which may move along tracks **20** as platform **80** rotates.

Another embodiment of the current invention involving a free swimming device **200** is now described with reference to FIG. **5**. Free swimming device **200** may comprise trolley **30** housing a water delivery device **10**. Free swimming device **200** may not require tracks **20** because it may move freely along the floor **3** of reservoir **2**. FIG. **5** shows the side view of free swimming device **200** comprising traveling along floor **3**.

Free swimming device **200** may be controlled by cables **250** which may include air lines **240** to actuate water shooter **10**, and electric or pneumatic control lines **230**. Control lines **230** may be used to drive moving trolley device **30** by various means such as, but not limited to, electric motors turning wheels or a combination of propellers and fins. The direction of free swimming device **200** may also be controlled by a wireless network (not shown). Multiple free swimming devices **200** may be used separate from or in conjunction with other track systems **100**.

Free swimming device **200** may be controlled by sensors connected to a computer/microcontroller (not shown) that may receive inputs from the sensors. In other words, free swimming device may decide where to go according to what it senses; i.e. it may act as an autonomous robot. Such autonomous control may be complete so that device **200** may make all its decisions, or control may be partial, for example, the movements of device **200** may be controlled by an independent software program outside of the sensor/computer/microcomputer system referenced above, but the autonomous sensor system may take over if a sensor detects a collision. Alternatively, device **200** could have other levels of autonomous control.

FIGS. **6** and **7** provide examples where different types of track systems **100** may be used in one water display **1** in reservoir **2**. As shown, grid systems, rotating platforms **80** and other systems may be used.

Lighting effects may be added to some or all of the embodiments including, but not limited to, water shooters **40**, and moving trolley devices **30**. Even though rotational boom **50** and rotational platform **80** may possibly be submerged, lighting effects may also be incorporated into their design to project light from under the surface of the reservoir.

The water display performances that may be provided by the current invention are now further described with references to FIGS. **8**A-**8**E, **9**A-**9**F and **10**A-**10**F. The current invention is not limited to the types of water displays shown therein since these are only examples. Instead, the current invention covers the movement of water delivery devices **10** to provide water streams that appear to move about a reservoir.

FIGS. **8**A-**8**E show a sequence of pictures whereby two water streams are provided as their respective water delivery devices travel along a circular track. As shown, as devices **10** travel, the configuration of the water patterns they provide may vary, e.g., the width and height of the water fans may vary.

FIGS. **9**A-**9**F show a sequence of pictures whereby two water streams are provided as their respective water delivery devices travel along concentric circular tracks. As shown, the configuration of water patterns may vary significantly as they travel about the reservoir.

FIGS. **10**A-**10**F show a sequence of pictures whereby one, and then two water streams are provided as their respective water delivery devices travel along a grid track system. As shown, the configuration of water patterns may vary significantly as they travel about the reservoir.

Although certain presently preferred embodiments of the invention have been described herein, it will be apparent to those skilled in the art to which the invention pertains that variations and modifications of the described embodiments may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A water display, comprising:

a reservoir that includes walls containing water and that includes a surface which is submerged in the water;

one or more generally circular or oval shaped tracks that are submerged in the water, and that are mounted to and extend along the submerged surface;

one or more additional tracks that are coupled to the one or more generally circular or oval shaped tracks, that are submerged in the water and that are mounted to and extend along the submerged surface;

a moveable platform that is submerged in the water and that engages the one or more generally circular or oval shaped tracks and the one or more additional tracks; and

at least one water delivery device that is coupled to the submerged moveable platform and that emits a stream of water having an upward trajectory which is unobstructed and which is visible to one or more observers beyond the reservoir;

wherein the submerged moveable platform travels on the one or more generally circular or oval shaped tracks and the one or more additional tracks along the submerged surface in the reservoir and thereby moves the water delivery device to different locations in the reservoir.

2. The water display of claim **1**, wherein the surface includes a track grid and the movable platform travels along the track grid.

3. The water display device of claim **2**, wherein the track comprises a plurality of tracks arranged in a grid.

4. The water display of claim **1**, wherein the track includes a rotating boom and the movable platform travels along the rotating boom.

5. The water display device of claim **4**, wherein the rotating boom comprises a track and the movable platform travels on the track of the rotating boom.

6. The water display of claim **1**, wherein at least a portion of the at least one water delivery device is submerged in the water.

7. The water display of claim **1**, further comprising a rotating platform mounted to the surface, wherein the track is mounted to the rotating platform and the movable platform travels on the rotating platform.

8. The water display device of claim **7**, wherein the rotating platform comprises a track and the movable platform travels on the track of the rotating platform.

9. The water display of claim **1**, wherein the movable platform includes one or more wheels.

10. The water display of claim **1**, wherein the water delivery device is coupled to the movable platform via a gimbal.

11. A water display, comprising:

a reservoir that includes walls containing water and that includes a surface which is submerged in the water;

a track that is submerged in the water, and that is mounted to and extends along the submerged surface;

a moveable platform that is submerged in the water and that engages the track; and

at least one water delivery device that is coupled to the submerged moveable platform and that emits a stream of water having an upward trajectory which is unobstructed and which is visible to one or more observers beyond the reservoir;

wherein the submerged moveable platform travels on the track along the submerged surface in the reservoir and thereby moves the water delivery device to different locations in the reservoir; and

wherein the track comprises one or more generally circular or oval shaped tracks.

12. A system for providing a moving water display, comprising:

a reservoir that includes walls containing water and that includes a surface which is submerged in the water; and

a moveable platform that is submerged in the water;

at least one water delivery device that is coupled to the submerged moveable platform and that emits a stream of water having an upward trajectory which is unobstructed and which is visible to one or more observers beyond the reservoir;

a propulsion mechanism that is submerged in the water and that is coupled to the submerged moveable platform;

wherein the submerged moveable platform is propelled by the propulsion mechanism to travel along the submerged surface and thereby move the water delivery device to different locations in the reservoir;

wherein the surface includes a track and the movable platform travels along the track; and

wherein the track comprises one or more generally circular or oval shaped tracks.

13. The system of claim **12**, wherein the surface includes a rotating boom and the movable platform travels on the rotating boom.

14. The system of claim **13**, wherein the rotating boom comprises a track and the movable platform travels on the track of the rotating boom.

15. The system of claim **12**, wherein at least a portion of the water delivery device is submerged in the water.

16. The system of claim **12**, further comprising a rotating platform mounted to the surface and the movable platform travels on the rotating platform.

17. The system of claim **16**, wherein the rotating platform comprises a track and the movable platform travels on the track of the rotating platform.

18. The system of claim **12**, wherein the movable platform includes one or more wheels.

19. The system of claim **12**, wherein the water delivery device is coupled to the platform via a gimbal.

20. The system of claim **12**, wherein the track comprises a plurality of tracks arranged in a grid.

21. A water display, comprising: a reservoir that includes walls containing water and that includes a submerged surface, a generally circular or oval shaped track which is submerged in the water and which is mounted on and extends along the submerged surface, and at least one water delivery device that is coupled to a moveable platform which is submerged in the water, and that emits a stream of water having an upward trajectory which is unobstructed and which is visible to one or more observers beyond the reservoir, wherein the submerged moveable platform is configured to move along the track along the submerged surface.

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